THE MAIN BUSINESS OF SCIENCE

To the thinking man it is almost self-evident that the finest fruits of Art or Science are the products of leisure. They ripen slowly and when forced lose something in flavor and quality. It is well for us to bear this in mind as we strive to direct Science into ways of social service—to make it "practical", "economic." There is always a danger—a very slight danger perhaps but nevertheless a very real danger—that in endeavoring to make it immediately valuable we may make it ultimately valueless. We may produce a large fruit crop that will appease a present hunger, but that will give little nourishment. This is no argument against any "economic" science, nor even against Science economically directed. It is a caution to those who may be tempted to make Science completely subservient to Economics.

Obviously the first business of a man is to live; but it is not his sole nor greatest business. He must live in some manner conformable with Truth. Similarly as regards Science. Her one business is to serve human necessity; for if she do not this then there is no ethical justification for her whatever. But her other and greater business is the seeking of Truth for its own sake. With such a two-fold understanding we admit at once the possibility of a conflict of interests in both the human and scientific worlds. Just as a man, who wishes to live as he should, must be ready to sacrifice his life; so Science, that would be of the greatest service, must sometimes give the search for Truth precedence over the economic problem of the moment.

There is no need to stress the point. As far as Science is concerned, conflict between the ideal and the practical is imminent only if we insist upon reducing scientific study to a purely utilitarian basis. In that event freedom disappears and with it the opportunity for any lasting or finally valuable contribution.

So much for generalities. The point of the argument is this: that those who support science—the government, the corporations, the public—should recognize the need of purely scientific research and provide for it generously. Science should be subsidized as Science, not merely as an adjunct to agriculture, industry, commerce or health; and the scientist should be assured of sufficient leisure for the most far-reaching investigations.

He on his part must not forget his obligation as a public servant; but in his endeavor to serve he should also be careful not to confound service with servitude."—CARL HEINRICH.

TESTIMONY

My garden bears testimony to divinity;
I sow the seed, itself a mystery;
Invoke the graces of the sun;
Implore the ministry
Of the rain; and yet, when this is done,
It is God
Who thrusts up
Through the imprisoning clod
Miracles of emerald leaf and radiant bloom,
Fashioned of fabrics from a heavenly loom.
Surely none but God can,
Within a seed's pin-point of space,
Pack a blue-print of the Cosmo's swaying grace,
Or, from a dry brown root release
The Phlox in all its white peace.
He hangs the Rose upon the thorn,
And lifts the Lily's Samite cup
Brim with the dewy nectar of the morn.
It is God alone, knowing infinitely,
May be so prodigal of beauty
That he gives to the errant winds the poppy
And the Rose, or yields to Winter's Devastating hold
Autumn's arabesques of flame and gold.

EVA MOAD TURNER.

—*Gardeners' Chronicle of America.*

THE TRAGEDY OF THE UNFIT

The selection of those who shall be admitted to the privilege of a fine education at much less than cost is fundamentally a study in social justice. It involves the rights of faculty members who are investing their own lives in the next generation, the rights of generous philanthropists and of hard-working tax-payers, the rights of those who will finish as well as those who will withdraw; finally, the rights of parents and students who regard college as final opportunity to prepare for lives of service, as well as those who consider a college education a delightful experience made up of some study, much play, interesting associations, multicolored activities. . . . Of the class of 1931 who will begin work in September, there will be three groups of students: (1) those who will succeed and ultimately receive diplomas; (2) those whom personal considerations will face to withdraw; (3) those who cannot or will not make good.—MORTON SNYDER, in *Progressive Education.*

—*What The Colleges Are Doing.*

THIRD LIST OF CYANOPHORIC PLANTS OF MAQUILING REGION[1]

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This brief report on the determination of plants of the Maquiling region that contain prussic acid (or hydrocyanic acid) is a continuation of similar studies reported by Herbert (1922) and Juliano (1923). A large number of plants were tested for the presence of prussic acid but only the plants that were found to contain the acid are here reported.

The method employed to detect the prussic acid in the plants was similar to that employed by Herbert. That is, the material to be tested was cut into small pieces. From the cut sections a 10-gram sample was taken and put into a small bottle containing 100 cubic centimeters of sodium picrate solution to which a little chloroform had been added. The bottle was then stoppered and set aside for an hour. If prussic acid was present the solution became red; if no prussic acid was present the solution remained yellow. The scientific and vernacular names of the plants used were checked with *An Enumeration of Philippine Flowering Plants* by E. D. Merrill, (1923-1926) and are listed below according to the alphabetical arrangement of the family names:

ANACARDIACEAE

Semecarpus cuneiformis (Ligas): Positive in roots and bark; trace in leaves and wood parenchyma.

Spondias cytherea: Trace in roots, bark, and leaves.

Spondias pinnata: Positive in leaves; trace in roots and bark.

ANONACEAE

Anona squamosa (Ates): Positive in leaves, bark, and roots; trace in wood parenchyma; negative in the pulp; slight in the seeds.

BOMBACACEAE

Bombax ceiba (Buboy-gubat): Positive in roots, stem, and leaves.

BORAGINACEAE

Cordia myxa (Anonang): Positive in roots, fruit, bark, and leaves; trace in wood parenchyma.

Heliotropium indicum (Hinlaloyon): Positive in leaves, bark, flowers, fruit, and roots; negative in wood parenchyma.

EUPHORBIACEAE

Aleurites moluccana (Lumbang): Positive in stem and fruit; trace in leaves; negative in roots.

[1]Experiment Station contribution No. 557. Received for publication, August 24, 1928.

A. trisperma (Baguilumbang): Positive in roots and bark; trace in leaves, flowers, pulp of fruit and wood parenchyma.
Euphorbia trigona (Sorog-sorog): Positive in leaves, bark, roots, and stem.
Jatropha curcas (Tuba): Positive in leaves, bark, roots, and fruit; trace in wood parenchyma.
J. multifida (Maná): Positive in roots, stem, and leaves.
Mallotus philippensis (Banato): Positive in roots, stem, and leaves.
M. ricinoides: Positive in roots, bark, and leaves; trace in wood parenchyma.
Ricinus communis (Tañgan-tañgan): Positive in roots, bark, and leaves; trace in wood parenchyma.

LABIATAE

Ocimum basilicum (Solasi): Positive in leaves, bark, and roots.

LECYTHIDACEAE

Gustavia gracillima: Positive in roots, bark, leaves, fruit; trace in wood parenchyma.

LEGUMINOSAE

Cassia fistula: Positive in roots, stem, and leaves.

LYTHRACEAE

Lagerstroemia speciosa (Banaba): Positive in roots, stem, and leaves.

MALVACEAE

Sida acuta (Ualisualisan): Positive in leaves, bark, and roots.

MORACEAE

Artocarpus communis (Rimas): Positive in leaves, stem, and roots; negative in fruit.
A. integra Merr. (Nanca): Positive in stem, leaves, fruit, and flowers.
Castilloa elastica (Rubber tree): Positive in bark, roots, leaves, and fruit.
Ficus cumingii (Isis na puti): Positive in stem and roots.
F. hauili (Hauili): Positive in roots, stem, and leaves.
F. nota (Tibig): Positive in stem, roots, leaves, fruit, and flowers.
F. odorata (Paquiling): Positive in stem, roots, and leaves.
F. pseudopalma (Niog-niogan): Positive in stem and roots.
F. stipulosa (Balete): Positive in stem, roots, and leaves.
F. ulmifolia (Isis, Asis): Positive in bark, roots, and leaves.
Morus alba (Mulberry): Positive in stem, roots, and leaves.

MYRTACEAE

Eugenia jambos (Tampoi): Positive in roots, stem, and leaves.

OXALIDACEAE

Averrhoa carambola (Balimbing): Positive in leaves, roots, and stem.

PASSIFLORACEAE

Passiflora edulis (Pasion): Positive in roots and stem; trace in leaves.

SAPINDACEAE

Guioa perrottetii (Salab): Positive in roots, stem, and leaves.

STERCULIACEAE

Kleinhovia hospita (Tanag): Positive in roots and leaves; trace in stem.
Sterculia foetida (Calumpang): Positive in roots, stem, and leaves.

TILIACEAE

Columbia serratifolia (Anilao): Positive in leaves and roots; trace in stem.
Corchorus capsularis (Pasao): Trace in bark; negative in leaves and roots.

Grewia multiflora (Danglin): Positive in leaves and roots; trace in stem.
Triumfetta bartramia (Calot-calotan): Positive in roots, leaves, and stem.

VERBENACEAE

Premna odorata (Alagao): Positive in leaves, stem, roots, and fruit.
P. subscandens (Alagao-baguing): Positive in leaves, stem, and roots; trace in flower and fruit.

VITACEAE

Cissus trifolia (Calit-calit): Positive in stem, leaves, and roots; trace in flower and fruit.
Tetrastigma harmandii (Ayo): Positive in leaves; trace in stem.

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THE BEHAVIOR OF THE ANTIMONY ELECTRODE IN BUFFERED AND UNBUFFERED SOLUTIONS[1]

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WITH TWO CHARTS

INTRODUCTION

For several years efforts have been made in this laboratory to find a suitable non-gas electrode for determining in a continuous manner, the hydrogen-ion concentration of different solutions. The main considerations which determine the suitability of an electrode for pH determination are: (1) its constant behavior at a given pH regardless of the presence of other substances such as proteins, salts, "poisons", etc.; (2) the quick response it gives after being placed in the solution; (3) the wide range of pH at which it can be used; (4) the ease with which it can be prepared and its cheapness; and (5) its sturdiness together with the very little attention required for its proper working.

The object of the work here reported was to test the behavior of the antimony electrode in buffer solutions, in partially neutralized solutions of acid and base, in soil solutions and in sugar solutions, with a view to determining the constants E_o and a of the equation $E_{obs}=E_o+a\ pH$, and the possibility of this electrode for controlling sugar juice clarification.

The antimony electrode was first used by Uhl and Kestranek (1923) as a method for determining the end point of neutralization reactions. Besides showing that a sharp potential drop was obtained at the end point, they found that the presence of chlorides and ammonium salts did not affect the determination of this point. Later, Kolthoff and Hartong (1925) extended the use of the antimony electrode to the determination of hydrogen-ion concentration of different buffer solutions, and they found that while for acid media, a definite linear relation obtained between the potential and the hydrogen-ion concentration, this same relationship did not obtain in alkaline media. According to them at 14°C. and between pH 1 to 5, the relation $E=0.0415+0.0485\ pH$ held, while above pH 9 the relation was $E=0.009+0.0536\ pH$.

Franke and Willaman (1928) used the same electrode for measurement of hydrogen-ion concentration in the control of pulp and paper manufacture, and from a determination of the potentials at different hydrogen-ion con-

[1]Experiment Station contribution No. 558. Received for publication October 2, 1928.

centrations of buffer solutions, they found the relation $E=0.050+0.054\ pH$, to hold at 25°C., from about pH 1 to 12. Furthermore, they found that the potential at the antimony electrode was not affected by the presence of the sulfite radical.

Very recently, Snyder (1928) made use of the antimony electrode with the help of the Franke and Willaman formula, in the determination of the pH of soils, and found it to be in fair agreement with the hydrogen electrode.

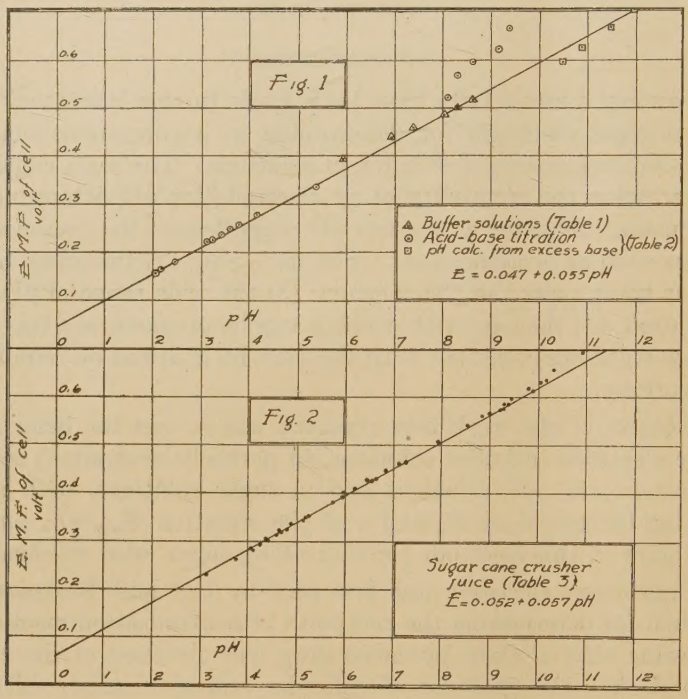

CHART 1

MATERIALS AND METHODS USED

Throughout this work, the temperature of experiment ranged between 26° and 29°C. The quinhydrone electrode in conjunction with the normal calomel electrode was used for determining the pH of the solutions, the formula used being $pH=\dfrac{0.4154-E_{obs}}{0.06}$

The antimony electrode was prepared from a Kahlbaum antimony metal powder. A glass tube of about 8 mm. diameter, closed at one end, was heated on a sand bath over a Bunsen burner, and molten antimony poured inside. The hot sand is to prevent sudden cooling, so as to allow normal crystallization of the antimony. As this powder was heated in air,

there was formed the white antimony trioxide (in some cases, the yellow pentoxide), so that there was actually no necessity of adding to the solution of unknown pH the antimony trioxide. The molded antimony was cut into pieces of about three or four centimeters each and forced through pyrex tubes of about the same diameter as the pieces of antimony; the tubes were heated at the junction of the antimony and the glass till the antimony started to melt; when cooled, this prevented the passage of solution inside the glass tube. The tube was then filled with mercury so that contact could be made with the wire leading to the potentiometer.

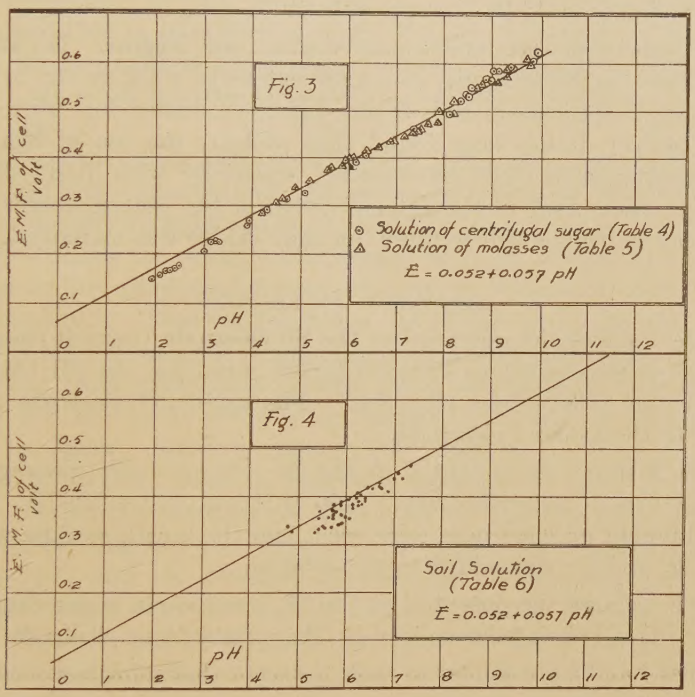

CHART 2

The buffer solutions (KH_2PO_4—NaOH mixtures) were prepared according to the method described by Clark (1922).

In preparing the acid-base mixtures for partial neutralization, 30 cc. of an approximately one-hundredth normal HCl were added to beakers containing different amounts of approximately one-hundredth normal NaOH, each mixture shaken and divided into two equal portions, one for the quinhydrone electrode, and the other for the antimony electrode.

The same method was used in varying the hydrogen-ion concentration of solutions of centrifugal sugar and molasses. In some cases, the solutions were treated with lime instead of sodium hydroxide, no appreciable dif-

ference in the behavior of the antimony electrode being found by use of either of the two bases.

The method adopted for determining the potential of the Sb electrode consists in putting the Sb electrode in the solution of unknown pH and shaking it during the reading of the potentiometer till the reading is constant. This usually takes place within one or two minutes. It is to be noted that no particular care is necessary in the handling of the antimony electrode, and that no solid or saturated solution is added to the solution. The mechanical work of shaking is no hindrance in the proper reading of the potentiometer, and in the case of sugar clarification the shaking need not be done, as the flow of the juice would be a proper substitute.

The soils used were representative soils from Negros. No attempt to describe these soils was made, as a more extensive work on the behavior of the antimony electrode in soils is now being conducted for future publication. However, it has been found that without the use of agar bridge[2] no consistent results could be obtained, especially with quinhydrone. It is for this reason that in the determination of the potentiometer readings of cells containing the soil solution, an agar bridge was employed.

DISCUSSION OF RESULTS

Table 1 shows the potential at the Sb electrode (normal calomel electrode = *O*) corresponding to different buffer solutions, the pH being determined by the quinhydrone electrode. The antimony electrode is always negative to the calomel electrode.

Table 2 shows the potential at the Sb electrode corresponding to different mixtures of approximately *N/100* HCl and *N/100* NaOH. In table 2 three different Sb electrodes were used, and the fourth reading was taken when Sb_2O_4 powder was added to the solution.

Table 3 shows the potential at the Sb electrode in sugar cane crusher juice, the pH also being determined by the quinhydrone electrode.

Tables 4 and 5 are similar to table 3, except that solutions of centrifugal sugar and molasses were used.

Table 6 shows the potential at the Sb electrode in different soils, no attempt to vary the pH of the samples being made. The pH were also checked by the quinhydrone electrode.

Figure 1, chart 1 shows the relation between the potential at the Sb electrode taken as positive in the figure and the pH of the solutions as determined by the quinhydrone electrode. Figure 1 corresponds to tables 1 and 2, figure 2, chart 1 to table 3, figure 3, chart 2 to tables 4 and 5, and figure 4, chart 2 to table 6.

[2] For the method of preparing agar bridge for use in soils work, *see* Baver, L. D. 1921. The use of the quinhydrone electrode for measuring the hydrogen-ion concentration of soils. Soil Science **21**: 167–179.

It will be seen from figure 1 that although in buffer solutions, the relation between potential and pH determined by the quinhydrone electrode is linear, in the case of the unbuffered solutions this is not true after pH 5.4. If, however, in the latter case, the pH be calculated from the amount of excess alkali in the solution (assuming 96 per cent ionization), it will be found that the same linear relationship obtains as for buffer solutions and for unbuffered solutions up to pH 5.4. The abnormal curve from pH 5.4 up in the unbuffered solutions must be ascribed to the slight changes in the impurities of the solution (e. g. CO_2, water itself, soluble glass, etc.), and to the ionization of hydroquinone as a weak acid, thus participatin in the acid-base equilibrium through neutralization. In fact, La Mer and Parsons (1923) showed that in the titration of 0.2 N acetic acid with 0.2 N sodium hydroxide the deviation of quinhydrone electrode from the hydrogen electrode is 2.4 pH at pH 8.5, the pH determined by the quinhydrone electrode being the less.

In figure 1 the relation $E = 0.047 + 0.055\ pH$ was obtained by applying the method of least squares to the data for buffer solutions (table 1) and to the data for unbuffered solutions up to pH 5.4 (table 2).

Figure 2 shows the perfect relationship, in crusher juice, between pH determined by the quinhydrone electrode and the potential at the Sb electrode up to pH 9.5. That the relation is not perfect above this pH may be explained by the ionization of hydroquinone as a weak acid, and it would be expected that since sugar cane crusher juices are buffered solutions, the deviations will not be as great as in ordinary acid-base titration, a fact shown by the figure. Since the relation holds good up to pH 9.5, it may be stated that for crusher juice at least, the quinhydrone electrode may be used up to this pH, a conclusion not supported by other workers. It would, however, appear that the Sb electrode has a wider range of application for determining pH than the quinhydrone electrode. Unfortunately, for lack of time, the writers were not able to compare the Sb electrode with the hydrogen electrode, but it is well known that besides being cumbersome the hydrogen electrode also fails when used in the presence of proteins and other "poisons".

From tables 4 and 5 and from figure 3 it is evident that the antimony electrode may also be used to advantage in pH determination of centrifugal sugar and molasses. The equation obtained from table 3 was used in calculating errors in tables 4 and 5. The greater errors obtained in solutions of centrifugal sugar is probably due to the fact that these solutions are not as highly buffered as the crusher juice.

Also, from table 6 and from figure 4 it is evident that the antimony electrode may also be used for determining pH of soils; the errors, however, are not as small as in the case of crusher juice; furthermore, it is not known whether it is the quinhydrone electrode or the Sb electrode which fails. The formula used for calculating the pH from the potentiometer reading is the same as that obtained in table 3.

Theory regarding the behavior of the antimony electrode

The oxidation-reduction reaction at the antimony electrode may be formulated, thus:

$$Sb_2O_3 + 3\ H_2O \rightleftharpoons 2\ Sb(OH)_3\ (solid)$$

$$\downarrow\uparrow$$

$$Sb(OH)_3 \rightleftharpoons Sb^{+++} + 3\ OH^-$$

$$\downarrow\uparrow$$

$$Sb$$

The mass action equation for the ionization of the hydroxide is

$$\frac{(Sb^{+++})\ \ (OH^-)^3}{(Sb(OH)_3)} = K$$

The potential at the oxidation-reduction electrode (Sb electrode) may be written as:

$$E = E_1 - \frac{RT}{nF}\ ln\ \frac{(Red)}{(Oxi)} \qquad (1)$$

where E = potential at the Sb electrode
E_1 = constant, involving electronic concentration of the metal and the equilibrium constant of the oxidation-reduction reaction,
(Red) = concentration of the reductant,
(Oxi) = concentration of the oxidant.

The other letters have their usual significance.

Therefore, the potential at the Sb electrode may be written as

$$E = E_1 - \frac{RT}{3F}\ ln\ \frac{(Sb)}{(Sb^{+++})}$$

or

$$E = E_1 - \frac{RT}{3F}\ ln\ \frac{(Sb)\ \ (OH^-)^3}{K(Sb(OH)_3)} \qquad (2)$$

Since $Sb(OH)_3$ is very insoluble, it may presumed that the amount of the Sb_2O_3 mixed with the metal is sufficient to keep the concentration of the hydroxide constant. The value of (Sb) may also be considered as constant. Furthermore,

$$(OH^-) = \frac{10^{-14}}{(H^+)}.$$

Therefore, equation (2) may be written as

$$E = E_1 - \frac{RT}{3F}\ ln\ \frac{(Sb)\ \ (10^{-14})^3}{K(Sb(OH)_3)\ \ \ (H^+)^3}$$

Gathering the constants,

$$E = E_o + \frac{RT}{F}\ ln\ (H^+) \qquad (3)$$

At 26° - 29°C., the value of $\frac{RT}{F}$ is very nearly equal to 0.06, so that transforming into pH,

$$pH = \frac{E_o - E}{0.06} \qquad (4)$$

It is to be noted that the potential at the Sb electrode is negative to calomel, so that taking the sign into consideration, equation (4) is equivalent to equation

$$pH = \frac{E - E_o}{0.06} \qquad (4a)$$

Comparing the value, 0.06, of $\frac{RT}{F}$ with the constant a (from 0.055 to 0.057) which was found from the different solutions, it is seen that there is a little discrepancy between the experimental and theoretical values. Further study is necessary to explain this discrepancy.

SUMMARY

1. The behavior of the Sb electrode has been tested in buffer solutions and in different mixtures of *N/100* NaOH and *N/100* HCl. It was found that at 26°–29°C. the pH of a solution may be determined by means of the antimony electrode, and with the help of equation $E = 0.047 + 0.055\ pH$. The constants found are somewhat different from those reported by previous workers.

2. This electrode was also tested in sugar solutions and the relation found, at 26°–29°C., is

$$E = 0.052 + 0.057\ pH$$

It is suggested that since the Sb electrode requires no particular care, is mechanically sturdy, cheap, gives a quick response after being placed in solution, and has a wider range of pH values at which it can be used, this electrode may be used to advantage in the continuous reading of pH in sugar juice during clarification. For sugar clarification the potential range to be registered by the recording apparatus must be between 0.25 to 0.55 volts, corresponding to from pH 4 to pH 9.

3. The antimony electrode has also been tried for use with soils, with results similar to those obtained by Snyder. More experiments are being carried out to explain the cause of the errors involved.

4. The value of the constant a calculated from the writers' data differs somewhat from the value of $\frac{RT}{F}$ $(=0.06)$ which is according to theory, but this discrepancy is not appreciably large. Further experiments are necessary to explain this difference.

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TABLE 1

e. m. f. of Sb, Sb_2O_3—HA—calomel, at different pH. ($t = 26° - 29°C.$)

PH OF BUFFER SOLUTION (DETD. BY QUINHYDRONE ELECTRODE)	E. M. F. OF CELL CONTAINING BUFFER SOLUTIONS					MAXIMUM DEVIATION FROM MEAN
	1 *volt*	2 *volt*	3 *volt*	4 *volt*	(mean) *volt*	(*volt*)
5.98	0.388	0.389	0.390	0.391	0.390	0.002
6.96	0.436	0.439	0.439	0.438	0.438	0.002
7.44	0.455	0.460	0.457	0.459	0.457	0.003
8.06	0.484	0.484	0.483	0.482	0.483	0.001
8.36	0.500	0.503	0.500	0.501	0.501	0.002
8.67	0.521	0.521	0.518	0.519	0.520	0.002

TABLE 2

Relation between e. m. f. of cell, Sb, Sb_2O_3—HA—calomel, and pH ($t = 26° - 29°C.$)
Acid-base titration (approximately *N/100* HCl against approximately *N/100* NaOH)

ACID	BASE	MEAN OBS. E.M.F. OF CELL	$E = 0.047 + 0.055$ pH				DIFF. (OBS.—CALC. PH
			Max. deviation from mean	Obs. pH by the quin. electrode		Calc. pH	
cc.	*cc.*	*volt*	*volt*				
30	0	0.158	0.002	2.07		2.02	+0.05
30	5	0.164	0.002	2.22		2.13	+0.09
30	15	0.182	0.002	2.51		2.45	+0.06
30	25	0.219	0.002	3.15		3.16	−0.01
30	26	0.226	0.001	3.25		3.25	0
30	27	0.238	0.003	3.45		3.47	−0.02
30	27.5	0.247	0.002	3.60		3.64	−0.04
30	28	0.256	0.002	3.78		3.80	−0.02
30	28.5	0.279	0.002	4.21		4.22	−0.01
30	29	0.335	0.006	5.39		5.24	+0.15
(30)	(29.5)	(0.386)		(6.46)			
(30)	(29.5)	(0.349)	?	(6.45)			
(30)	(30)	(0.422)	?	(7.28)			
(30)	(30)	(0.399)		(7.37)			
30	30.5	0.521	0.010	8.13		8.62	−0.5
30	31	0.565	0.010	8.36		9.42	−1.1
30	32	0.593	0.004	8.64	(10.49[a])	9.93	+0.6
30	35	0.624	0.004	9.14	(10.87[a])	10.49	+0.4
15	30	0.664	0.006	9.39	(11.50[a])	11.22	+0.3
0	30	0.704	0.006	10.84	(11.98[a])	11.94	+0.04

[a] Calculated from the amount of excess base, assuming 96 per cent ionization.

TABLE 3

Crusher juice at 26° – 29°C.
Relation between pH (determined by the quinhydrone electrode) and the potential at the Sb electrode
$E = 0.052 + 0.057\ pH$

NO.	pH (QUINHYDRONE)	OBS. E. M. F. AT SB	CALC. pH	(OBS.–CALC.) pH
		volt		
1	4.72	0.321	4.72	0.00
2	4.92	0.336	4.98	–0.06
3	5.14	0.346	5.16	–0.02
4	5.22	0.350	5.23	–0.01
5	5.74	0.380	5.72	+0.02
6	5.99	0.400	6.11	+0.12
7	6.24	0.408	6.25	–0.01
8	6.49	0.424	6.53	–0.04
9	6.65	0.430	6.64	+0.01
10	6.88	0.448	6.95	–0.07
11	9.22	0.572	9.13	+0.09
12	9.36	0.583	9.32	+0.04
13	10.05	0.632	10.18	–0.13
14	3.14	0.233	3.18	–0.04
15	4.08	0.282	4.04	+0.04
16	4.41	0.305	4.44	–0.03
17	4.60	0.311	4.55	+0.05
18	4.80	0.322	4.74	+0.06
19	5.24	0.352	5.62	–0.02
20	5.95	0.385	5.84	+0.12
21	6.57	0.428	6.60	–0.03
22	7.25	0.461	7.18	+0.07
23	7.93	0.501	7.88	+0.05
24	8.57	0.540	8.56	+0.01
25	9.26	0.575	9.18	+0.08
26	9.77	0.615	9.70	+0.07
27	3.73	0.263	3.70	+0.03
28	4.11	0.282	4.04	+0.07
29	4.29	0.293	4.23	+0.06
30	4.43	0.301	4.37	+0.06
31	4.69	0.321	4.72	–0.03
32	7.35	0.459	7.14	(+0.21)
33	8.85	0.561	8.93	–0.08
34	9.00	0.567	9.04	–0.04
35	9.88	0.612	9.83	+0.05
36	9.31	0.584	9.33	–0.02
37	9.45	0.594	9.51	–0.06
38	10.17	0.642	10.35	–0.18
39	10.35	0.654	10.56	–0.21
40	10.93	0.692	11.23	–0.30
41	11.21	0.719	11.70	–0.49
42	11.98	0.755	12.33	–0.35
43	12.22	0.780	12.77	–0.55
44	6.89	0.450	6.98	–0.09
45	7.42	0.462	7.09	(+0.33)
46	7.91	0.500	7.86	+0.05

TABLE 4

Solution of centrifugal sugar (10%) at 26° – 29°C. Relation between pH (determined by the quinhydrone electrode) and the potential at the Sb electrode.

$E = 0.052 + 0.057\ pH$

NO.	pH	OBS. E. M. F. AT SB	CALC. pH	DIFF. (OBS.–CALC.) pH
		volt		
1	2.22	0.162	1.93	+0.29
2	2.50	0.175	2.16	+0.34
3	3.16	0.226	3.05	+0.11
4	3.91	0.260	3.65	+0.26
5	4.33	0.295	4.26	+0.07
6	6.19	0.391	5.95	+0.24
7	7.40	0.459	7.14	+0.26
8	8.53	0.532	8.42	+0.11
9	8.59	0.551	8.75	–0.16
10	8.90	0.562	8.95	–0.05
11	8.98	0.565	9.00	–0.02
12	9.45	0.593	9.50	–0.05
13	9.13	0.584	9.33	–0.20
14	9.96	0.628	10.11	–0.15
15	1.97	0.150	1.72	+0.25
16	2.16	0.158	1.86	+0.30
17	2.32	0.163	1.95	+0.37
18	2.43	0.170	2.07	+0.36
19	3.00	0.208	2.74	+0.26
20	3.24	0.222	3.00	+0.24
21	3.30	0.226	3.07	+0.23
22	3.92	0.267	3.77	+0.14
23	4.74	0.311	4.54	+0.20
24	5.09	0.325	4.79	+0.30
25	8.15	0.494	7.76	+0.39
26	8.36	0.523	8.26	+0.10
27	9.05	0.586	9.37	–0.32
28	9.40	0.596	9.54	–0.14
29	9.84	0.610	9.79	+0.05
30	6.38	0.403	6.16	+0.22

TABLE 5

Solution of molasses (10%) at 26° – 29°C. Relation between pH (determined by the quinhydrone electrode), and potential at the Sb electrode E = 0.052 + 0.057 pH

NO.	pH (OBS.)	OBS. E. M. F.	CALC. pH	DIFF. (OBS.–CALC.) pH
		volt		
1	5.55	0.374	5.65	–0.10
2	5.62	0.377	5.70	–0.08
3	5.86	0.386	5.86	–0.00
4	5.93	0.394	6.00	–0.07
5	6.12	0.400	6.11	+0.01
6	6.39	0.412	6.32	+0.07
7	6.63	0.422	6.49	+0.14
8	6.87	0.433	6.69	+0.18
9	7.18	0.445	6.90	+0.28
10	7.44	0.456	7.09	+0.35
11	7.86	0.475	7.42	+0.44
12	7.50	0.457	7.11	+0.39
13	8.48	0.534	8.46	+0.02
14	8.79	0.558	8.88	–0.09
15	9.32	0.577	9.21	+0.11
16	9.80	0.600	9.61	+0.19
17	4.19	0.285	4.09	+0.10
18	4.52	0.309	4.51	+0.01
19	4.65	0.318	4.67	–0.02
20	4.92	0.337	5.00	–0.08
21	5.20	0.351	5.25	–0.05
22	5.99	0.397	6.05	–0.06
23	6.89	0.434	6.70	+0.19
24	7.67	0.471	7.35	+0.32
25	8.17	0.493	7.74	+0.43
26	9.11	0.563	8.96	+0.15
27	9.34	0.587	9.39	–0.05
28	9.46	0.596	9.54	–0.08
29	6.15	0.408	6.21	–0.06
30	6.91	0.437	6.76	+0.15
31	7.19	0.449	6.97	+0.22
32	7.35	0.453	7.03	+0.32
33	7.54	0.464	7.23	+0.31
34	7.89	0.500	7.86	+0.03
35	8.26	0.522	8.25	+0.01
36	8.68	0.549	8.72	–0.04
37	9.70	0.611	9.81	–0.11

TABLE 6

Solutions of soils at 26° – 29°C.
Relation between pH (determined by the quinhydrone electrode) and the potential at the Sb electrode
$E = 0.052 + 0.057\ pH$

INDEX NO. [a]	pH (OBS.)	OBS. E. M. F. AT SB ELECTRODE	CALC. pH	DIFFERENCE (OBS.-CALC.)
		volt		
4-A Isabela....	5.81	0.369	5.56	+0.2
42-B Manapla...	6.75	0.413	6.33	+0.4
13-B Binalbagan	7.35	0.462	7.19	+0.2
40-B Manapla...	7.07	0.448	6.95	+0.1
11-B Binalbagan	6.23	0.397	6.05	+0.2
10-B Binalbagan	4.86	0.339	5.03	−0.2
13-A Binalbagan	6.89	0.410	6.28	+0.6
37-B Victorias...	5.74	0.360	5.40	+0.3
9-B Binalbagan	5.87	0.385	5.84	0.0
11-A Binalbagan	5.45	0.368	5.54	−0.1
36-A Victorias...	6.47	0.418	6.42	+0.1
38-B Victorias...	6.72	0.428	6.60	+0.1
13-B Isabela....	7.18	0.435	6.72	+0.5
12-B Binalbagan	6.71	0.421	6.47	+0.2
9-A Binalbagan	6.03	0.390	5.93	+0.1
8-B Isabela....	5.91	0.384	5.82	+0.1
2-A Isabela....	6.29	0.401	6.12	+0.2
20-A La Carlota.	6.26	0.388	5.89	+0.4
6-A Isabela....	6.29	0.403	6.15	+0.1
6-B Isabela....	6.55	0.417	6.40	+0.1
14-B La Carlota.	6.15	0.381	5.77	+0.4
20-B La Carlota.	6.12	0.375	5.67	+0.4
1 (clay) Isabela..	7.00	0.435	6.71	+0.3
16-A La Carlota.	5.42	0.354	5.30	+0.1
16-B La Carlota.	5.72	0.379	5.74	−0.2
17-A La Carlota.	5.87	0.381	5.73	+0.1
17-C La Carlota.	6.42	0.391	5.95	+0.5
20-C La Carlota.	6.32	0.381	5.77	+0.5
14-A La Carlota.	6.39	0.394	6.00	+0.4
15-B La Carlota.	6.25	0.384	5.82	+0.4
19-B La Carlota.	6.12	0.374	5.64	+0.5
21 La Carlota.	5.72	0.356	5.33	+0.4
22 La Carlota.	5.63	0.352	5.26	+0.4
30-B Talisay....	5.89	0.361	5.42	+0.4
32-A Talisay....	6.61	0.376	5.68	+0.9
32-B Talisay....	6.18	0.365	5.49	+0.7
33-A Talisay....	4.91	0.328	4.84	+0.1
33-B Talisay....	5.74	0.370	5.58	+0.1
34-A Talisay....	5.54	0.330	4.88	+0.7
35-A Talisay....	5.91	0.345	5.14	+0.8
35-B Talisay....	5.86	0.340	5.05	+0.8
15-A La Carlota.	6.10	0.356	5.33	+0.7
19-A La Carlota.	5.67	0.337	5.00	+0.7
23-A Bacolod ...	5.57	0.334	4.95	+0.6
25-A Bacolod ...	5.45	0.355	4.95	+0.5
26-A Bacolod ...	5.37	0.327	4.82	+0.5
28 Bacolod....	5.55	0.338	5.02	+0.5
29-A Bacolod ...	6.01	0.357	5.35	+0.6

[a] The soils together with their index numbers were obtained from Dr. R. L. Pendleton of the Soils Division, Department of Agronomy.

PHILIPPINE FARMERS' TAX GUIDE[1]

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The power of taxing the people and their property is essential to the very existence of government, and may be legitimately exercised on the objects to which it is applicable to the utmost extent to which the government may choose to carry it. The only security against the abuse of this power is found in the structure of the government itself.—Chief Justice Marshall.

The Philippine farmers constitute an important unit of the tax-paying population of the country. They contribute heavily to the support of the government in the payment of the Real Property tax and Income tax. Taxes on real property alone, the greater portion of which is paid by farmers, rank equal in importance as a source of government revenue with Business taxes, with Excise taxes, and with Import duties. The assessed valuation of real property subject to taxation in recent years is nearly ₱1,600,000,000 from which real property taxes of nearly ₱15,000,000 were collected. This tax which accrues to provinces and municipalities represents over 55 per cent of their total revenue from taxation.

In general, apathy towards paying taxes is common in the Philippines, hence they are often paid grudgingly. The methods of levy are not well understood, much less the spirit of taxation. Many a farmer has hazy ideas of his rights and privileges as provided by the laws to safeguard his interests against unjust impositions and practices. Consequently, there arises a tendency to seek excuses for evasion or delay in the payment of taxes, and there are likely to be partialities in the application of the tax laws to the detriment of the uninformed. There is, then, a great need for so important a body of taxpayers as our farmers to know the text of the tax laws which directly affect them so that they may understand the reasons for taxation, the methods of levy and collection, the penal provisions, and their rights and privileges in regard to taxation.

The task of levying and collecting taxes is vested in officials of the government. In the difficult and complicated nature of their work, inequalities and apparent partialities in the application of the tax laws often arise. The laws of the Philippine Islands provide ample safeguards of the rights and privileges of taxpayers against any abuse or injustice. Means for redress against unjust impositions and for the protection of the farmer's rights are provided. The present paper aims to help acquaint tax-paying

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farmers with the operation of important tax laws which directly concern them, and with their rights and privileges.

THE REAL PROPERTY TAX

Levy and disposition of proceeds of tax

The tax based on the value of real estate, which includes land, buildings, and other improvements, constitutes the real property tax. It is more commonly designated as the land tax, for a very great part of the taxable real property of the Islands consists of land, most of which is farm land. The proceeds of this tax go to meet the expenses of the provinces and municipalities where the land is situated. The minimum rate of taxation is three-eighths of one per cent of the value of real property, and the maximum rate of levy is seven-eighths of one per cent. The share of a province is levied by the provincial board upon a resolution passed on or before the last day of December of each year fixing a uniform rate of taxation for the succeeding year. The rate of levy is not less than one-eighth nor more than three-eighths of one per cent. The share of a municipality is likewise levied by passage of a municipal ordinance fixing a uniform rate of not less than one-fourth nor more than one-half of one per cent. Under actual practice, there is in force at the present time in the provinces and municipalities the maximum rate of seven-eighths of one per cent allowed by law. This rate has remained unchanged from year to year, with the provinces and municipalities sharing in the proportions specified by the tax law. The gross proceeds of the tax collected go to meet specified expenses of both the provincial and municipal governments. The proceeds of the first one-eighth of one per cent of the provincial levy accrue to its road and bridge fund, the proceeds of the remaining two-eighths of one per cent, to its general fund. The gross proceeds of the first one-fourth of one per cent of the municipal levy accrue exclusively to its school fund, the proceeds of the remaining one-fourth of one per cent to its general fund.

Assessment of the real property tax

There is in every province a provincial assessor. The provincial treasurer performs the duties of the provincial assessor at the present time. There may be appointed by the provincial assessor deputy assessors to help him perform the duties which his position carries. Owners and administrators of real property, that is land, buildings, and other improvements, are required by law to make a sworn declaration of their taxable property for purposes of taxation before the provincial assessor or the municipal secretary of the town where their real property is situated. Two classes of real property are recognized, rural and urban, for which separate forms for declaration purposes are provided in the office of the municipal secretary. If the land has been registered in the court of land registration, the number of the certificate of title should be given in the declaration and if the land

has been included in a cadastral survey, the lot number. Otherwise, sufficient description of boundaries should be given to make identification easy. The kind, area, annual production, and value of the land and improvements thereon should be given. Failure by an owner to declare any real property subject to taxation gives the assessor the right to make the required declaration for purposes of assessment and taxation. A notice of such action is sent to the owner. Farmers are allowed the following exemptions from taxation of certain properties:

a. Land held by a homesteader prior to obtaining a patent.
b. Machinery, this includes tools and implements used for agricultural purposes.
c. Fruit trees and bamboo plants growing on the farmer's land.

Each municipal council is required by the provincial board to prepare and submit a general schedule of the values of the different classes of land in the municipality. When the schedule of values is found to be impartial, just, and equitable, it is made the basis by the provincial assessor in his work of valuation and assessment of real properties. Any divergence of opinion between the municipal council and the provincial assessor arising from the equity of the schedule of values is given a hearing and decided by the Chief of the Executive Bureau; his decision must be approved by the Secretary of the Interior before it is valid.

The principle governing valuation of land and improvements is that the assessor should value them at their true and full value in accordance with the schedule of values in force in the municipality wherein they are situated. The assessor is therefore not bound to be guided by the sworn declaration of the owner as to valuations. The assessor may raise or lower valuations should he deem the change proper. In case the real property is assessed at a value greater than that appearing in the declaration of the owner, or when existing assessment is increased, the assessor is required to give immediate notice to the owner, executed in proper form provided for the purpose. Should the taxpayer consider the value assessed against his real property by the assessor to be excessive or unjust, he may file with the municipal council a written statement of his objections to the action of the assessor. Such appeal is executed in a prescribed form obtainable at the office of the municipal secretary and it should be accompanied by the owner's original declaration. Any written proofs to strengthen his claims may accompany his appeal and oral argument may be made before the municipal council. Should taxes on the property become due while the appeal is pending, they should be paid "under protest," for a refund of any excess in taxes may later be claimed if the appeal is decided in the owner's favor. Action by the municipal council is required within thirty days after receipt of such appeal. From the decision of the municipal council, appeal may be made within ten days to the provincial board, either by request of the aggrieved farmer or by the provincial assessor. Appeal from the decision

of the provincial board as to the justice and equity of particular assessments, may be made either by the owner of the property or by the municipal council to the Chief of the Executive Bureau whose decision as to the fairness of the assessment is final when approved by the Secretary of the Interior and concurred in by the Governor General. Procedure of such appeals may be found in the form for appeals referred to above.

Revisions of valuations of land and other real property in any province or municipality may be made only once in two years when the provincial assessor is so directed by the provincial board.

The collection of the real property tax

The real property tax becomes due and payable to the municipal treasurer on the first day of January of each year. According to law the Governor General fixes a special period of three months in each year for the collection of the tax in the respective provinces. The period fixed may be any three successive months of the year. The Governor General must act before the last day of December of the year preceding that in which it is to take effect, and at least three months before the beginning of the period fixed. The term of collection may be extended for another three months by the provincial board upon approval of the Governor General. The special term of collection of the tax in any province may be postponed at the discretion of the Governor General to any period within the year. In case of calamities, as general failure of crops or other wide-spread disaster in any specified district, the tax may be remitted wholly or partially by action of the provincial board and approved by the Secretary of the Interior or by order of the Governor General. Notices are posted in every municipality designating the period during which the real property tax is payable, and the municipal treasurer collects and receives the tax from taxpayers.

In accordance with present practice, the land tax is due and payable in organized provinces not later than May 31. In certain provinces there are special periods for collection to suit local conditions. Land tax in Palawan must be paid on or before June 30; in Abra, Batanes, and La Union, on or before July 31; in Cagayan and Isabela, on or before November 30.

Penalties

For the enforcement of the collection of the land tax, three kinds of penalties are imposed in case of delinquency. A progressive rate of surcharges is added to the tax, personal property of the delinquent taxpayer may be subject to seizure and sale, and finally land on which the taxes are not paid is held subject to forfeiture to the government whose title after a certain period becomes absolute.

After May 31, the last day for the payment of the real property tax, a penalty of 10 per cent of the tax due is added when it is paid not later than September 30; the penalty increases to 20 per cent when paid after the last

date but not later than December 31; if the delinquency continues, a penalty of 30 per cent is imposed when the tax is paid not later than March 31 of the year following; and the penalty is increased to 40 per cent when paid after the last mentioned date.

When delinquency in the payment of the tax occurs, personal property of the taxpayer may be subject to seizure by the provincial treasurer or his deputy, and so much of it may be sold at public auction as to satisfy taxes due, together with the penalties and costs. Some items of personal property of the farmer are not subject to seizure and sale, the most important of which are:

a. Tools and implements.
b. One horse, cow or carabao.
c. Necessary clothing of the family.
d. Household furniture and utensils not exceeding ₱75 in value.
e. Provisions for family use sufficient for three months.

If on June 1 one year after a tax was due on land, and no seizure of personal property has been made, the tax and penalties remain unpaid, the land is forfeited to the government. Ninety days from date of notice of such delinquency issued by the provincial treasurer, government title to the land becomes absolute, the owner is dispossessed of it, occupants are ejected, and the land is subject to sale and disposition.

Redemption

The delinquent taxpayer is given every opportunity to safeguard his personal interests even after penalties have been imposed for non-payment of taxes. When any personal property is seized for non-payment of taxes, the owner may redeem it before sale is made by paying the tax, penalty, and costs incurred. After the delinquent land is forfeited to the government and within ninety full days from date of notice published stating such forfeiture, the owner may redeem the land, by the payment of taxes and penalties due. After the lapse of ninety days from the publication of this notice, if land is not redeemed, government title to the land becomes absolute and is subject to sale and disposition. The owner is, however, given the further right of repurchase from the government before any sale is made, by the payment of all taxes, penalties, and costs due, plus an additional charge of 10 per cent of the whole amount.

THE FARMER'S INCOME TAX

Farmers, of course, like all other persons, are subject to an income tax levied and collected annually on net income as defined by law. All farmers having a gross income of ₱4,000 or more, for the taxable year, are required to file income tax returns with the treasurer of the province, or municipal treasurer of the municipality where they are resident, although the returns may show no tax liability. These returns made on special forms, which

are furnished, must be filed after the close of the calendar year, and on or before the first day of March. Failure to file such returns on time, subjects the delinquent to payment of a penalty of fifty per cent of the amount of the tax and a specific penalty of from 40 to 2,000 pesos. Fraudulent returns showing understatement of income subjects one to a penalty of one hundred per cent of the tax due, and he is liable to a specific fine not exceeding ₱4,000 or imprisonment of not exceeding one year, or both.

The gross income of the farmer includes the total amount received from the sale of crops, live stock and other farm products, plus the receipts from other sources as, salaries, wages, or commissions received during the year, gross income from any other business he conducts or from any trade in which he has an interest, rents received, interest received and other income. As the tax is levied upon net income, the farmer in submitting his personal income tax returns should ascertain his net income after itemizing his gross income. Certain specific deductions from gross income are allowed by law, the most important of which are as follows:

1. Amounts paid by the farmer for labor in preparing his land for a crop, and the cultivation, harvesting, and marketing of the crop.
2. Cost of the seeds and fertilizers used.
3. Amounts paid for labor in caring for live stock.
4. Cost of feed for live stock.
5. Expenses in repairing farm buildings, except dwelling house.
6. Expenses in repairing fences, farm machinery, etc.
7. Cost of materials for immediate use, and of ordinary farm tools of small cost which are used in the course of a year or two.
8. Rent paid for the farm.
9. Taxes paid during the year except special assessments and inheritance taxes.
10. Interest paid within the year on indebtedness.
11. Losses incurred in the operation of the farm. Loss by storm, flood or fire may be deductible if the value of crop has been returned as income. Cattle raisers may claim deductions for animals that die, if the value of such animals have been returned as income. Loss from death of live stock kept for farm use may be deducted not at the full actual purchase price but at this price less depreciation.
12. Depreciation of farm property, such as tools, machinery and live stock.

There are expenses not allowed as deductions from gross income, the most important of these are:

1. Personal, living, and family expenses.
2. Expenses which represent investments of capital as:
    a. Purchase of farm machinery.
    b. Permanent tools and equipment of the farm.
    c. Work animals, and live stock held either for resale or for breeding purposes.
    d. Expenses for erection of farm buildings.

From the net income, ascertained as outlined above, the farmer is allowed a personal exemption which is deducted from the net income. The exemptions are:

1. For an unmarried person ..... ₱4,000
2. For a married person ..... ₱6,000

A further exemption of ₱400 for each individual child under twenty-one years of age dependent upon such person for support is allowed.

The rate of tax

A normal tax of three per cent is levied upon net income after deductions and personal exemptions have been made. Incomes in excess of ₱10,000 are subject to an additional tax, the rates of which are progressive. These rates are shown in the form for income tax returns.

The collection of the tax

Between January 1 and June 1 the Insular Collector of Internal Revenue notifies all farmers subject to payment of tax of the amount of tax assessed against them. Payment must be made to the municipal treasurer or provincial treasurer not later than June 15 following the taxable year. After this date and ten days after notice and demand have been made, the delinquent taxpayer is subject to pay a penalty of five per cent of the amount of the tax due, and interest at the rate of one per cent per month. He is also liable to payment of a specific penalty of from 40 to 2,000 pesos

Rights and privileges of taxpayer

Returns may be filed after March 1 following the taxable year without subjecting one to the penalties prescribed by law if a request for extension of time is granted by the Collector of Internal Revenue in cases when the delay is caused by absence or illness. Any one feeling that he has been assessed an income tax in excess of his true tax liability may pay the tax so assessed "under protest"; such protest to be made within ten days after payment. This claim is filed with the Collector of Internal Revenue for decision. In case his action is adverse, or if no decision is rendered by him within six months from the date when the protest is made, the taxpayer may proceed at any time within two years after payment of the tax to bring action in the courts against the Collector of Internal Revenue for the recovery without interest of the sum believed to be in excess of his tax liability.

PHILIPPINE REAL PROPERTY TAX CALENDAR FOR FARMERS

January 1—May 31, inclusive. The real property tax becomes due and payable to the municipal treasurer. Special periods for the collection of the tax are provided for the following provinces: Palawan to June 30 of each year; Batanes, La Union, and Abra to July 31 of each year; Cagayan and Isabela to November 30 of each year.

June 1—September 30, inclusive. A penalty of 10 per cent is added to the amount of the tax due when paid within these dates. Personal property of delinquent taxpayer is subject to seizure by the provincial treasurer or his deputy and may be sold to satisfy taxes and penalties due.

October 1—December 31, inclusive. The penalty is increased to 20 per cent of the amount of the tax due when paid within this period. Personal property continues to be subject to seizure and sale.

January 1—March 31, inclusive. The penalty is increased during this period to 30 per cent and personal property continues to be subject to seizure and sale.

April 1—May 31, inclusive. The penalty is increased to 40 per cent and personal property is still subject to seizure and sale.

June 1, and after. The delinquent land is by law forfeited to the government. After ninety days from date of notice of delinquency and forfeiture issued by the provincial treasurer, government title to land becomes absolute, and is subject to sale and disposition.

PHILIPPINE INCOME TAX CALENDAR FOR FARMERS

January 1—March 1, inclusive. Period for filing with municipal treasurer income tax returns for the last taxable year. Returns filed after March 1 subjects one to the payment of a penalty of 50 per cent of the amount of tax assessed, and a specific penalty of from 40 pesos to 2,000 pesos.

On these dates, the Collector of Internal Revenue sends out notices to income taxpayers stating amount of tax due and upon date of receipt of notice, the income tax becomes due and payable.

March 2—June 1, inclusive. The Collector of Internal Revenue continues to send out notices to income taxpayers stating amount of tax due. Income tax continues to become due and payable to municipal treasurers.

June 2—June 15, inclusive. Income tax continues to become due and payable to the municipal treasurer.

June 16—and thereafter. After this date, and ten days after notice and demand is made for the tax by the Collector of Internal Revenue, a penalty of 5 per cent of the amount of the tax due is added, and interest at the rate of 1 per cent per month. The delinquent taxpayer is also held liable to payment of a specific penalty from 40 pesos to 2,000 pesos.

FORMS IN CONNECTION WITH REAL PROPERTY AND INCOME TAXES WITH WHICH FARMERS SHOULD BE FAMILIAR

Real property tax forms

Provincial Form No. 136—Notice of Assessment, Declared Property. This is issued by the Provincial Assessor when valuations and area reported by the farmer are increased. This form is accompanied by the original declaration of the owner, Provincial Forms Nos. 140 or 141.

Provincial Form No. 137—Notice of Assessment on undeclared land issued by the Provincial Assessor to owner of undeclared land for his information.

Provincial Form No. 138—Notice of revision of assessment issued by the Provincial Assessor when assessment reported previously is increased.

Provincial Form No. 139—Appeal on excessive assessment obtainable at the office of the municipal secretary; filled out by a farmer when he appeals to the municipal council on assessments believed to be excessive or unjust.

Provincial Form No. 140—Declaration of real rural property filled out by farmers for purposes of assessment. This form is submitted to the Provincial Assessor or his deputy.

Provincial Form No. 141—Declaration of real urban property filled out by farmers for purposes of assessment. This form is submitted to the Provincial Assessor or his deputy.

Provincial Form No. 142—Revision of declaration of real rural property forwarded by the Provincial Assessor to the Provincial Treasurer and to the farmer on every authorized revision of assessment.

Provincial Form No. 143—Revision of declaration of real urban property forwarded by the Provincial Assessor to the Provincial Treasurer and to the farmer on every authorized revision of assessment.

Provincial Form No. 72—Certificate of absolute forfeiture sent to the Director of Lands by the Provincial Treasurer in case of a lapse of one year of delinquency.

Income tax form

Bureau of Internal Revenue Form No. 17.01—Income tax returns declaration to be filled out by farmers in the columns applicable to his business.

A STUDY ON THE GROWTH OF COCONUT[1]

J. BUENO F. FANDIÑO

WITH ONE CHART

The coconut palm is among the most important of all the valuable oil-bearing plants. The use of its oil as a raw material for the manufacture of human food products began only a few years ago but the demand is growing very rapidly.

The Philippines, in response to this growing demand for coconut products, is increasing, notably, its coconut plantings in some regions. This expansion has brought about a demand for reliable information on the coconut plant.

It is believed that the study here reported on the growth of the nuts will furnish much desired information.

REVIEW OF LITERATURE

Gonzales (1914), Vista (1915), and Copeland (1921) observed that the young nuts are relatively long and slender; later, they grow in width rather than in length, so that finally nearly all the mature nuts of most varieties are wider than they are long. Copeland maintains that these changes in shape are more prominent in the case of the shell than of the whole fruit, including the husk. According to Vista the meat begins to form when the nut is about six months old. Sampson (1923) is more definite and states that the meat commences to form when the nut is about 168 days of age. At 308 days, the meat is fully formed, but the shell husk has not completely hardened. He further says that the shell fully hardens when the nut is ripe, that is, when it is about 364 days old.

TIME AND PLACE OF THE PRESENT STUDY

This investigation was begun during the latter part of April, 1927, but the actual measurement of the nuts began on May 1, of the same year and continued until January 15, 1928. The trees used in this study are located in the coconut grove belonging to Mr. N. Galves in Los Baños Municipality.

MATERIALS AND METHODS

All of the nuts of ten bearing trees were studied[2]. All the bunches on each tree beginning with the oldest were labeled, as bunch 1, 2, 3, etc., and

[1] Thesis presented for graduation, 1928, with the degree of Bachelor of Agriculture, from the College of Agriculture No. 272; Experiment station contribution No. 560. Prepared in the Department of Agronomy under the direction of Dr. Vicente C. Aldaba.

[2] One tree died in August, 1927, so that the nuts of only nine trees were studied to the end of the investigation.

all the nuts of each bunch were numbered 1, 2, 3, etc., with a light pencil lining beginning with the nut at the base of each cluster. Each nut was marked longitudinally and transversely to indicate the points where measurements were to be made. Weekly measurement was taken, using a wooden caliper.

In order to study the growth of the different parts of the nut, one nut was taken from each bunch of a prolific tree and cut into halves, after measuring its length and width. Fourteen nuts in all stages of growth were thus gathered from the fourteen bunches.

RESULTS

Just after the opening of the spathe most of the young nuts were found to be elliptical in outline with the cross-section diameter greater than the longitudinal. In each bunch, some nuts were found that were nearly round in outline. No nut with longitudinal diameter greater than the transversal was observed.

In analyzing the data the biweekly average of the growth of all the nuts in each bunch was computed and plotted. The chart presented in this paper is typical of all the other nuts studied. It should be mentioned in this connection that all the curves are remarkably similar. It is very interesting to note the relation between the growth in width and in length of the nuts, as shown in the graph. For the first few weeks the growth in width is slower than the growth in length. But during the first few weeks the curve of the growth in width rises more rapidly than the growth in length, until the growth in width becomes much faster than the growth in length. The growth in width remains more rapid than that in length for three or four months and then drops faster than that of the length, so that in the last two or three months the growth in width is again slower than the growth in length.

The measurement of the parts of the nuts at different stages of development are given in table 1. Examining the table, it may be seen that when the nut is about two months old, the endocarp, which becomes the hard shell, begins to appear distinct. It is white, creamy, soft and membraneous. From this time on, it thickens gradually until the nut is six to eight months old. About this time the endocarp begins to harden, changing from cream color to brown. Hardening starts at the part opposite the eyes, progressing gradually towards the eyes. This observation agrees with that of Sampson (1923). The endocarp attains its full thickness when the nut is about eight months old.

When the nuts are five months old, the endosperm, which in mature nuts is known as the meat, begins to form at the portion opposite the eye, as a gelatinous substance, somewhat yellowish in color. At the age of six to seven months the endosperm appears to be formed all around the inside of the endocarp, but is still thicker at the bottom. Beginning with the

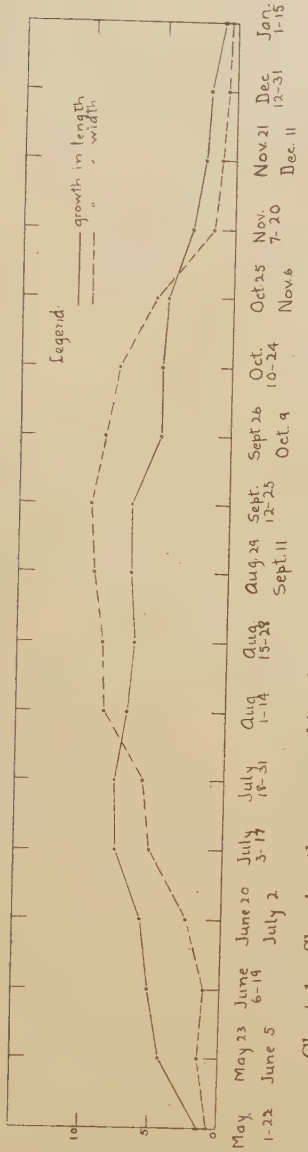

Chart 1.—Showing the average biweekly growth of all the nuts in bunch No. 9 of tree No. 2.

formation of the endosperm up to the time the nut is about nine months old, thickening of the meat is rather rapid. At the age of about nine months the endosperm attains practically its maximum thickness.

The mesocarp, which is known popularly as the husk, varies in thickness at different places. The upper and lower ends of the mesocarp in all nuts appears thicker than the sides. The upper ends thicken rapidly from the time the nut is four and a half months old until it matures, while the two sides of the mesocarp gains in thickness slowly. The mesocarp of the young nut is yellowish in color and rather compact in structure. As the nut matures the color changes to brown.

Measurements of the husked nuts show that the tendency is to grow, when young, in length more than in width. This growth in length continues until the nut is four to four and a half months old. From this age, the tendency is to grow faster in width than in length until the nut matures. At maturity the husked nut is wider than long.

A further study of table 1 shows that from the time the nut begins to grow faster in width than in length, the upper end of the mesocarp thickens rapidly. This explains why the nut with husk is longer than wide, while the husked nut is wider than long.

At the age of nine to ten months the nut attains the full size. The exocarp is still green, turning brown as the nut matures.

DISCUSSION OF RESULTS

From general observation it has been concluded by certain writers that the nut, at first, grows faster in length than in width, and during the rest of its growing life faster in width than in length. This conclusion is only partly correct. As shown in the chart the growth in length is faster than the growth in width during the first few weeks, then for several months the rate of growth in width becomes faster than the rate of growth in length, and in the last period the growth in width is slower than the growth in length.

A detailed examination of table 1 reveals a very interesting phenomenon in the development of the nut. This development may be divided into three more or less distinct stages. In the first stage the growth is mainly in the area of the two parts of the nuts; namely, the husk and shell. This takes place from the appearance of the nut to about the age of four or five months. During this time these parts grow very slowly in thickness. The cavity during this period assumes practically the maximum space. Thus the growth of the husk and the shell are mainly in the direction of increase in surface resulting in greatly increased cavity.

The second stage of growth is from the age of about four or five months to between six and eight months. During this time, the husk and the shell grow very rapidly in thickness. The meat appears, but its growth in thickness is not completed until the nut is about nine months old.

The third and last stage of growth, which is mainly in the direction of maturity, may be considered to begin at the age of eight months At this stage, the husk changes from dull-white to brown color, and the shell turns from brown to black. With the meat, however, the stage of maturity does not begin until about the age of nine months, when it assumes its full thickness. Then the color begins to change from pure white to dull-white, and the texture becomes very compact.

CONCLUSION

1. The nut grows in length faster than in width at first, then it grows faster in width, and finally again faster in length.

2. There are three more or less distinct stages in the development of the nut: (1) In the first stage, which lasts to the age of four to five months the growth is mainly in area of the husk and the shell; the cavity assumes practically the maximum space during the period; (2) the second stage lasts until the nut is about six to eight months old. The meat appears and the husk and shell grow rapidly in thickness; (3) the third stage is from the time the nut is eight months old until maturity. During this period, the husk, shell, and meat change in color.

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TABLE 1

Measurements of the different parts of the nuts at different stages of maturity

AGE	HUSK				SHELL	MEAT	HUSKED NUT		EXTERNAL MEASUREMENT		HOLLOW PORTION (COMPUTED)	
	Upper end	Lower end	Narrowest side	Opposite the narrowest side			Longitudinal diameter	Cross-sectional diameter	Length	Width	Longitudinal diameter	Cross-sectional diameter
	cm.	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*
1 month	——	——	——	——	——	——	——	——	3.1	3.1		
2 months ...	0.5	3.0	1.5	1.5	——	——	1.3	0.8	4.9	3.6	1.30	0.80
2½ months .	0.7	3.0	1.5	1.7	.15	None	3.2	1.5	7.7	4.4	2.05	1.35
3 months ...	0.8	3.0	1.5	1.7	.20	"	6.1	3.4	9.9	6.3	5.90	3.20
3¾ months .	0.8	3.0	1.5	1.6	.30	"	8.2	5.8	12.3	8.8	7.90	3.30
4 months ...	0.8	2.9	1.4	1.7	.30	"	9.2	7.6	13.3	10.8	8.90	7.30
4½ months .	1.5	2.5	1.6	1.8	.35	"	10.3	10.7	15.2	14.3	9.95	10.35
5¼ months .	2.7	2.4	1.7	2.1	.35	*a*	10.7	12.0	17.1	15.9	10.35	11.65
6¾ months .	3.8	2.5	1.7	2.6	.35	0.3	10.5	12.4	17.6	15.9	9.85	11.75
8¼ months .	3.5	3.0	1.6	2.3	.40	0.6	11.2	13.2	18.8	17.1	10.20	12.20
9¾ months .	3.6	3.0	1.7	2.5	.40	1.0	11.1	13.3	19.0	17.6	9.70	11.90
10 months...	2.8	2.5	1.6	2.1	.40	1.0	11.5	14.1	18.1	17.9	10.10	12.70
Mature	3.7	2.8	1.4	2.4	.40	1.1	10.7	11.9	17.8	15.8	9.20	10.40
Mature	3.5	2.5	1.3	2.3	.40	1.2	11.7	12.4	19.0	16.3	10.10	10.80

[a] Formation of the meat at the bottom.

A STUDY ON THE PREPARATION OF HOG RATION AS RELATED TO GROWTH AND DEVELOPMENT OF PIGS[1]

SALVADOR F. BOLIVAR

WITH ONE CHART

INTRODUCTION

One of the factors determining success or failure in pork production is the manner in which feeds are prepared before giving them to hogs. The feeds making up the ration should meet the physiological needs of the pigs and the feeder's requirement—economy. Proper preparation may help the feeds to meet both objects.

It is a common practice among hog feeders in the Philippines to cook or to prepare feeds in the most convenient way without regard to the class and condition of the pigs, or to the changes that may take place in the physical and chemical composition of the feeds.

Several ways of preparing feeds are known in this country, but just which to recommend under a given condition or set of conditions is not known. It was the object of this investigation to determine what manner of preparation of the hog ration should be advised for weanling pigs.

Past work on the subject

Allen (1901) compared cooked or steamed barley meal, corn meal, and shorts; whole corn; whole corn and shorts; peas, corn, and oatmeal; potatoes, and a mixture of peas, barley, and rye with the same feeds uncooked. He found that in ten trials there had been no gain from cooking, instead, there has been a positive loss.

Spencer (1913) reports the results of feeding cooked potatoes, carrots, meal (corn and barley), milk, and alfalfa to 17 three months old pigs which made a daily gain of 1.2 pounds a pig; they required 3.23 pounds of dry matter to produce 1 pound live weight. Another set of 17 pigs fed on the same ration but uncooked made an average daily gain of 1.32 pounds; they required 2.96 pounds of dry matter to produce 1 pound live weight.

Henry (1894) in his work with pigs, using corn meal which had been cooked into a thick mush and corn meal moistened with hot water and fed at the same temperature as the mush, found that it required 439 pounds of cooked feed, or 454 pounds of uncooked feed to make 100 pounds of gain.

[1] Thesis presented for graduation, 1928, with the degree of Bachelor of Science in Agriculture from the College of Agriculture No. 273; Experiment Station contribution No. 561. Prepared in the Department of Animal Husbandry under the direction of Dr. Mariano Mondoñedo.

Smith (1920) states that cooking is a detriment rather than a benefit with the usual hog feeds.

Henry and Otis (1907) report that 140 pigs fed a ration of shelled corn as the principal feed consumed an average of 501 pounds ration for every 100 pounds gain. Another lot of 140 pigs with corn meal as the principal feed required 471 pounds ration for the same amount of gain.

Wheeler (1893) compared corn meal with ear corn on 2 lots of 4 pigs, for 63 days. Pigs on corn meal made larger and more economical gains than pigs on ear corn.

Stewart and Atwood (1899) experimenting on feeding whole corn and corn meal to 3 lots of 3 pigs each, found that pigs receiving whole corn required 5.39 pounds to make a pound of gain, and of the two lots receiving corn meal, one required 4.75 and the other 4.63 pounds of corn meal to make a pound of gain.

Kennedy and Robbins (1909) state that pork produced from 312 hogs fed on soaked corn meal costs more per pound gain than from hogs fed on soaked shelled corn.

Mackay (1894) in experiments where 4 pigs were fed wheat soaked for 24 hours found that the pigs made 1 pound gain for every 4.5 pounds ration. Another lot of 6 pigs on boiled wheat ration made 1 pound gain for every 6 pounds of ration.

Stewart and Atwood (1899) in their work with 2 lots of 6 pigs each, where one lot was fed whole corn soaked in water until soft and the other lot was fed with corn meal mixed with water, report that the pigs fed whole corn, soaked, consumed 3.85 pounds for every pound of gain. Those fed on corn meal required 4.1 pounds for every pound of gain.

Bliss and Lee (1914) report that 10 pigs fed soaked ground wheat for 84 days consumed 4.43 pounds per pound of gain. Ten pigs fed soaked whole wheat for the same length of time consumed 5.91 pounds for every pound of gain. Nine pigs on a 98-day test fed on whole wheat, soaked, required 5.04 pounds of grain per pound of gain, while another lot of 9 pigs fed on ground wheat, soaked, needed only 4.13 pounds of grain for every pound gain.

The Ohio Experiment Station reported in 1922 that hogs fed on shelled corn made returns of 2 cents a bushel more than hogs on ear corn; fed on corn meal, 8 cents a bushel more; on corn meal moistened as a slop, 9 cents a bushel more.

Object of the experiment

The object of this experiment was to determine, for weanling pigs, the most efficient preparation for a ration consisting of 20 parts corn, 60 parts rice bran, 15 parts copra meal, and 5 parts dried shrimps with 1 per cent of a mineral mixture added to the ration.

Time and place of the work

These experiments were conducted at the Public Breeding Station of the Department of Animal Husbandry, College of Agriculture. The first experiment was started on July 5 and closed on August 29, 1926, covering a period of 55 days. The second experiment was started on May 1 and closed on July 10, 1927. The third experiment was started on September 4 and closed on November 13, 1927. Each of the two last experiments covered a period of 70 days.

MATERIALS AND METHODS

Materials

The animals. The pigs used in the first experiment were 18 barrows purchased in the market of Calamba. They were about three and one-half months old at the beginning of the experiment. The animals were rather spare in condition. Judging from appearance, they were grade Berkshire pigs, about one-fourth Berkshire.

For the second experiment fifteen barrows were purchased in Calamba on April 22, 1927. They were about three and one-half months old, uniform in size and condition. They were Berkshire-Native grades.

Another lot of fifteen pigs of practically the same type, age, size, and condition as the pigs used in experiment II were bought in Calamba for the third experiment. Twelve were barrows and three were females.

Methods

Experiment I. There were two lots of pigs in this experiment. Both lots received the same ration, except that lot I was given uncooked ration, and lot II cooked ration.

Experiment II. Lot I ration was similar to that of lot I in experiment I except that the corn was shelled (instead of ground); lot II was given the same ration as lot I in experiment I except that the ration was soaked 10 to 14 hours before feeding, (instead of adding the water immediately before feeding as was done for lot I in experiment I). Lot III had exactly the same ration as lot I in experiment I.

Experiment III. Lot I received a soaked ration with shelled corn; lot II received a cooked ration with shelled corn; and lot III received a soaked ration with the corn ground.

It will be noted that there were placed under test six preparations of the same feeds and in the same proportion; namely,

1. Ration with ground corn; water added just before feeding.
2. Ration with ground corn; cooked.
3. Ration with ground corn; soaked.
4. Ration with shelled corn; water added just before feeding.
5. Ration with shelled corn; cooked.
6 Ration with shelled corn; soaked.

Feeding. All the lots in the three experiments were fed twice daily, between 6:00 and 7:00 a. m. and 4:00 and 5:00 p. m. The pigs were allowed all the feed they could easily consume. After feeding in the morning, clean water in clean troughs was placed before them. This was replenished at 11:00 a. m.

Weighing. The pigs were weighed weekly. All weights were taken at 4:00 p. m. before the pigs received their evening meal.

Care and management. Experiment I: The two lots of pigs were dry lot fed. There was no pasture available. Each lot occupied a pen in the hog house with an adjoining yard, 491.5 square meters in area. In the two adjoining yards occupied by the two lots there was always grass growing. However, very little of this grass could be utilized by the pigs as it was soiled and trampled the greater part of the time.

Experiment II and III: The pigs were separated by lots only at feeding. Between meals at night and in the day time all the pigs in the three lots of both experiments were allowed to run together in a common grass pasture, largely *Paspalum conjugatum*. It may be noted in this connection that by taking care that each lot of pigs was fed in the same pen and at the usual hours the pigs learned to separate themselves by lots and to run together in the same pasture after each feeding.

There were four pastures, one-sixteenth of a hectare each, available for use in these experiments. These were used in rotation of two weeks duration—that is, the pigs were allowed to use one pasture at a time for two weeks, then they were turned into the second pasture for the next two weeks and so on. In this manner the pigs were able to get a limited amount of fresh grass throughout the experimental periods.

There were trees growing all along the borders of the pasture lots, which served as shelter; a temporary shed of coconut leaves was erected in each pasture to protect the pigs from the heat of the sun. During stormy weather the pigs were put in the hog house.

Observations. Experiment I: (1). During the first few days the pigs on cooked ration did not relish their feed as much as did the pigs on uncooked ration. They got over this within two weeks. Throughout the feeding period, however, it was noted that it took the pigs on cooked ration longer to finish their meals, than the ones on uncooked.

(2). On August 2, following the discovery of ascaris infestation, the following prescription was given:

Oil of chenopodium	20 cc.
Tartar emetic	5 grams.
Oil of turpentine	75 cc.
Castor oil	225 cc.

Fifteen cc. was administered for every 10 kilograms live weight of the pigs. Both lots were heavily infested, as shown by the number of ascaris expelled.

(3). As the experiment proceeded, lot II, or the cooked ration lot frequently showed signs of loss of appetite, and at the same time the pigs frequently showed a strong liking for grass or any green feed accessible to them.

(4). Pigs in lot I appeared more vigorous and healthier than those in lot II.

(5). On August 3, pigs 164, 165, and 170 in lot I were found to be sick; they remained so for about a week. Pig 160 was sick for two weeks.

(6). On August 29 the experiment was brought to a close, as nearly all the pigs in both lots showed signs of sickness. There was an outbreak of *Hemorrhagic septicemia.*

Experiment II: (1). During the first three days of the experiment the pigs in lot I (shelled corn, unsoaked) did not seem to relish their feed, but later, showed good appetite which continued until the end of the experiment.

(2). Lot II (corn meal, soaked) consumed the greatest amount of feeds from the beginning up to the end of the experiment, and compared with the other two lots made the greatest increase in weight.

(3). Lot III (corn meal, unsoaked) stood about intermediate.

(4) The pigs in lot I during the first month of the experiment consumed more feeds than those in lot III, but from the second month on lot I lagged behind lot III both in amount of feeds consumed and in gains in weight.

Pigs in lot I which received shelled corn, showed, during the greater part of the time, frequent signs of constipation; the feces were hard and dry at times. The pigs on shelled corn passed out a large amount of the corn undigested. The corn used was Native Yellow Flint.

(5). With the exception of pigs 250 and 253 of lot I, the pigs in the three lots remained in good condition and had a fairly steady good appetite. Pig 250 had a good appetite, but remained unthrifty. Pig 253, while apparently in good condition with good appetite throughout the trial, remained the slowest gainer.

Lot II pigs readily consumed their ration; in fact, of the three lots of pigs, they ate the fastest. Lot I ate the slowest. If they were allowed to choose, the pigs in lot I left the shelled corn practically untouched.

The appearance of the three lots was markedly different at the close of the experiment. Lot I pigs looked spare, rangy, and weak-backed. They appeared to be restless, seemingly searching for food, while the pigs in the other two lots were more contented.

Lot II pigs were all in very good condition throughout the experiment, as was shown by their healthy looking eyes and smooth glossy hair.

In condition, lot III pigs were intermediate between lot II and lot I.

On the whole, all the pigs from the beginning until the end of the trial were apparently in good health. None of them was ever sick.

Experiment III: (1) The pigs in experiment III, like the pigs in experiment II, did not eat their meals with relish during the first week of the feeding test.

(2). The pigs receiving the cooked ration ate the fastest The pigs in lot I (shelled corn, soaked) took the longest to eat their feed.

(3). As the trial progressed, it became evident that the pigs in lot II on shelled corn cooked ration consumed the largest amount of feed of the three lots; this is shown in their weekly feed consumption. Lot III, on soaked ration with the ground corn, consumed more feed than the lot I pigs on soaked shelled corn. There were times during the trial when lot I gained more weight than lot II. This was the period from August 16 to August 30 (see chart 1).

The pigs in lots I and II suffered from constipation at times, lot I the most seriously. Throughout the trial the pigs in these two lots voided undigested corn. Rarely was undigested corn found in the excreta of lot III pigs.

(4). All the pigs, with the exception of pigs 295, 296, and 289 in lot I and 282 in lot II were in good condition at the end of the experiment.

These pigs, although apparently healthy and feeding well, failed to gain in weight as fast as the others under experiment. These pigs at the end of the experiment were thin and lanky; the mucous membrane of the eyes was congested, and the coat rough.

On the whole, the pigs in lot III were in very good condition, low set and plump. They were uniform in size, form, condition, appetite, etc., at the close of the experiment.

DISCUSSION OF RESULTS

Experiment I

It will be noted at once that contrary to the common belief of hog feeders in this country, pigs fed on cooked ration did not make as rapid gains as the pigs receiving uncooked ration. This is clearly shown in table 1 and in chart 1. The lot on uncooked feed made an average daily gain of 0.159 kilogram and the lot on cooked ration 0.106 kilogram, or the uncooked ration was 50 per cent more efficient in making gains than the cooked ration. This result corroborates the experience of hog feeders in America and other places who, as a general rule, advise the feeding of many common feeds in uncooked form.

It was observed that it took a longer time for the lot fed cooked ration to consume their meal, than those on uncooked ration. It is usually expected that cooking improves the palatability and digestibility of feeds, but the fact that in this case the pigs in the lot fed cooked ration did not relish their ration as much as did those on uncooked ration points to the possibility that the ration lost some of its palatability by cooking. It is possible that the lack in relish was due to the presence of copra meal which is very un-

palatable to pigs Using it in limited quantity with the other feeds without cooking they eat it well enough, but it appears that in cooking it with other feeds the rancidity of the copra meal permeates, or kills the flavor of the other feeds. It is also possible that the digestibility of the feeds may have been improved by cooking, but it is also possible that some of the unknown elements (vitamins) of the feeds may have been partly or wholly destroyed by cooking, so that gains made in digestibility by cooking were not sufficient to offset the loss of palatability and vitamins.

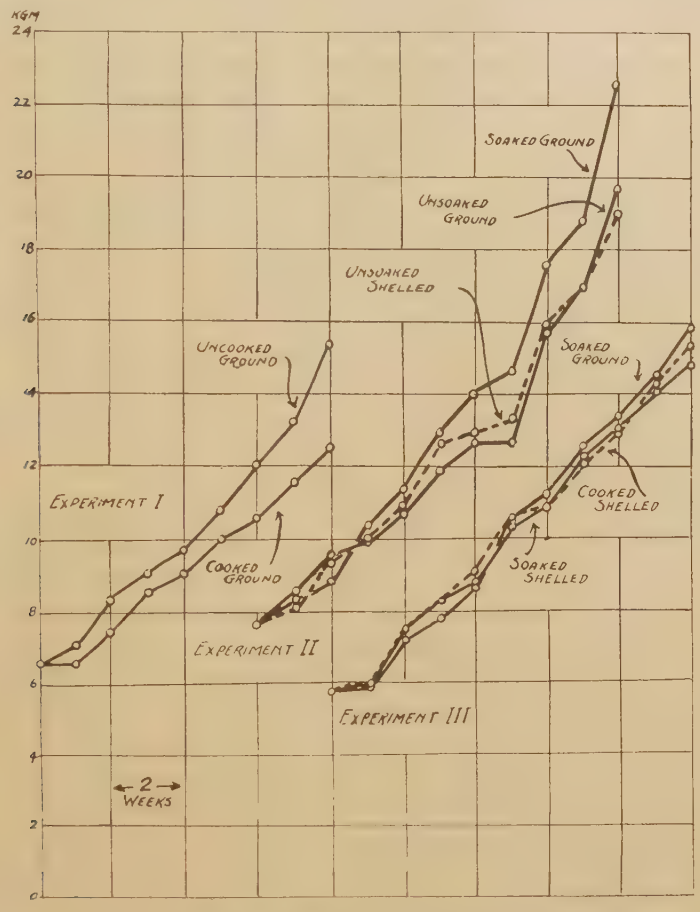

Chart 1.—Showing results in experiments I, II, III.

As may be seen in table 1, the pigs on uncooked ration made a kilogram gain in weight on 4 kilograms ration as against 4.7 kilograms ration required by the pigs on cooked ration.

The pigs on uncooked ration, in lot I were never off feed throughout the experiment. On the other hand, lot II pigs on the cooked ration sometimes could not consume all the feed usually allowed them at feeding time. In other words, they had capricious appetites.

Experiment II

It may be observed in table 2 that lot II pigs on soaked ground corn ration made the most satisfactory gains, followed by lot III pigs on unsoaked ground corn ration, with lot I on unsoaked shelled corn the least satisfactory.

Comparing the ration of lot II which gave the best and lot II the second best results it will be noted that the only difference between them is that the ration for lot II was soaked in water from 10 to 14 hours before it was given to the animals, while the ration of lot III was given to the animals immediately after a like amount of water, as used in the ration of lot II, was added. This one point of difference in the preparation of the ration seemed to be sufficient to cause a marked difference in results in favor of soaking.

The ration of lot I which gave the poorest results differs from the ration of lot III only in the preparation of corn. The rations were both unsoaked, but the corn in lot I was shelled corn, and in lot III, ground corn. The results show that the effect of grinding corn (Native Yellow Flint) for growing pigs (weanlings) is increased in the rate of gains, better health of the animals, and economy of gains.

The ration of lot II, which proved the best, differs from that of lot I, the one that gave the poorest, in two points; namely, it is *soaked* and the corn is *ground*. These two differences were sufficiently important to cause a wide margin in results in favor of soaking and grinding.

Table 2 shows that lot II (ration, soaked and ground) made an average daily gain of 0.21 kilogram live weight; lot III (ration, unsoaked and ground), 0.17 kilogram; and lot I (ration, unsoaked and shelled), 0.16 kilogram. Lot II required 3.1 kilograms, lot III, 3.6 kilograms, and lot I, 3.8 kilograms of feeds to make a kilogram gain.

Soaking and not soaking as shown above made quite a difference in the results, although there is practically no difference between the two in so far as expense and labor in their preparation is concerned.

In soaking the ration there followed an increase in the amount of feeds consumed, and a decrease in the amount of feeds required per unit of gain which goes to show that soaking may have improved the digestibility and palatability of the feeds. It is easy to see that soaking improves digestibility. In cooking, there is the possibility of decreasing the palatability of the ration owing to the presence of rancid oil in copra meal which mixes more or less intimately with the other feeds. In soaking, the possibility of diffusing the flavor of the rancid oil in copra meal is not so great as in the boiling and stirring in the process of cooking. Instead, an actual dilution takes place as the rancid oil is but a small part of a ration which consists largely of palatable constituents. Soaking makes the concentrates more succulent as evidenced by the fact that all the lots on soaked rations suffered from little or no constipation.

Experiment III

In this experiment the soaked ground ration which gave the best results in experiment II is included to compare it with soaked shelled corn and cooked shelled corn rations of this trial.

Table 3 shows that soaked ground corn ration is the best of the three preparations on trial. The pigs on soaked ground corn made an average daily gain of 0.15 kilogram as against 0.14 kilogram from cooked shelled and 0.13 kilogram from soaked shelled rations. To make a kilogram gain, the lot fed soaked ground corn required 3.15 kilograms of feed, the lot fed cooked shelled corn, 3.42 kilograms, and lot fed soaked shelled corn, 3.48 kilograms of rations.

The difference in the results among the three lots was not as marked as between the lots in experiment II. It may also be noted that in this instance cooked ration gave slightly better results than soaked shelled ration. The only way to account for this small difference in results obtained from cooked ration and from soaked ration is that the pigs in this experiment had access to more grass pasture than those on cooked ration in experiment I. The pigs in this experiment had access to good grass pasture the greater part of the trial period. It is more than likely that the deficiencies of the cooked shelled and soaked shelled rations incident to their preparation may have been made up to some degree by grazing.

CONCLUSIONS

1. It is not advisable to cook the ration for growing pigs, particularly for pigs on dry lot and for long periods of feeding. It is not only uneconomical but distinctly harmful.
2. It is advisable to soak the ration for growing pigs, particularly those on dry lot and on limited pasture.
3. Corn, particularly corn of the Flint variety, should be ground before feeding it to growing pigs.
4. A ration soaked with the corn ground gave the best results of all of the preparations tried in these experiments.

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TABLE 1

Showing summary of results of each lot in experiment I

	LOT I UNCOOKED RATION CONSISTING OF: CORN (GROUND). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "	LOT II COOKED RATION CONSISTING OF: CORN (GROUND). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "
Number of pigs	9	9
Duration of experiment	55 days	55 days
Total initial weight	59 kgm.	59 kgm.
Average initial weight	6.56 kgm.	6.56 kgm.
Total final weight	137.8 "	111.4 "
Average final weight	15.31 "	12.38 "
Total gain	78.8 "	52.4 "
Average gain per pig	8.755 "	5.822 "
Average daily gain per pig	0.159 "	0.106 "
Grain consumed:		
Corn	63.64 kgm.	49.44 kgm.
Rice bran	190.93 "	148.31 "
Copra meal	50.90 "	39.54 "
Dried shrimps	12.73 "	9.89 "
Total grain feed consumed	318.22 "	247.18 "
Cost of grain consumed:		
Corn @ ₱0.0854 per kilogram	₱ 5.44	₱ 4.22
Rice bran @ ₱0.060 per kilogram	₱11.46	₱ 8.90
Copra meal @ ₱0.035 per kilogram	₱ 1.78	₱ 1.38
Dried shrimps @ ₱0.24 per kilogram	₱ 3.06	₱ 2.36
Total cost of grain consumed	₱21.74	₱16.86
Average daily grain per pig	0.6429 kgm.	0.4993 kgm.
Grain feed consumed per kilogram gain	4.0383 "	4.7171 "
Cost of grain to produce 1 kilogram gain	₱ 0.2758	₱ 0.3217
Grain feed consumed per 100 kilogram gain	403.83 kgm.	471.71 kgm.
Cost of grain to produce 100 kilogram gain	₱27.58	₱32.17

TABLE 2

Showing summary of results of each lot in experiment II

	LOT I UNSOAKED RATION CONSISTING OF: CORN (SHELLED). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "	LOT II SOAKED RATION CONSISTING OF: CORN (GROUND). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "	LOT III UNSOAKED RATION CONSISTING OF: CORN (GROUND). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "
Number of pigs	5	5	5
Duration of experiment	70 days	70 days	70 days
Total initial weight	38.17 kgm.	38.15 kgm.	38.12 kgm.
Average initial weight	7.63 "	7.63 "	7.624 "
Total final weight	94.8 "	112.8 "	98.1 "
Average final weight	18.96 "	22.56 "	19.62 "
Total gain	56.63 "	74.65 "	59.98 "
Average gain per pig	11.326 "	14.93 "	11.996 "
Average daily gain per pig	0.1618 "	0.2132 "	0.1713 "
Grain consumed:			
Corn	42.56 kgm.	46.38 kgm.	43.16 kgm.
Rice bran	127.68 "	139.14 "	129.48 "
Copra meal	31.92 "	34.785 "	32.37 "
Dried shrimps	10.64 "	11.595 "	10.79 "
Total grain feed consumed	212.80 "	231.9 "	215.8 "
Cost of grain consumed:			
Corn @ ₱0.085 per kilogram	₱ 3.62	₱ 3.94	₱ 3.67
Rice bran @ ₱0.060 per kilogram	₱ 7.66	₱ 8.35	₱ 7.77
Copra meal @ ₱0.035 per kilogram	₱ 1.12	₱ 1.22	₱ 1.13
Dried shrimps @ ₱0.24 per kilogram	₱ 2.55	₱ 2.78	₱ 2.59
Total cost of grain consumed	₱14.95	₱16.29	₱15.16
Average daily grain per pig	0.608 kgm.	0.662 kgm.	0.617 kgm.
Grain feed consumed per kilogram gain	3.757 "	3.106 "	3.597 "
Cost of grain to produce 1 kilogram of gain	₱ 0.264	₱ 0.218	₱ 0.252
Grain feed consumed per 100 kilogram gain	375.77 kgm.	310.60 kgm.	359.70 kgm.
Cost of grain to produce 100 kilogram gain	₱26.40 ——	₱21.89	₱25.27

TABLE 3

Showing summary of results of each lot in experiment III

	LOT I SOAKED RATION CONSISTING OF: CORN (SHELLED). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "	LOT II COOKED RATION CONSISTING OF: CORN (SHELLED). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "	LOT III SOAKED RATION CONSISTING OF: CORN (GROUND). 20 PARTS RICE BRAN..... 60 " COPRA MEAL.... 15 " DRIED SHRIMPS.. 5 "
Number of pigs	5	5	5
Duration of experiment	70 days	70 days	70 days
Total initial weight	28.74 kgm.	28.77 kgm.	28.37 kgm.
Average initial weight	5.748 "	5.74 "	5.674 "
Total final weight	73.7 "	76.6 "	79.60 "
Average final weight	14.74 "	15.3 "	15.92 "
Total gain	44.96 "	47.73 "	51.23 "
Average gain per pig	8.995 "	9.546 "	10.246 "
Average daily gain per pig	0.1284 "	0.1363 "	0.1462 "
Grain consumed:			
Corn	31.26 "	32.88 "	32.30 "
Rice bran	93.78 "	98.64 "	96.90 "
Copra meal	23.445 "	24.66 "	24.225 "
Dried shrimps	7.815 "	8.22 "	8.075 "
Total grain feed consumed	156.30 "	164.40 "	161.50 "
Cost of grain consumed:			
Corn @ ₱0.085 per kilogram	₱ 2.60	₱ 2.73	₱ 2.68
Rice bran @ ₱0.060 per kilogram	₱ 5.06	₱ 5.33	₱ 5.23
Copra meal @ ₱0.035 per kilogram	₱ 1.17	₱ 1.23	₱ 1.21
Dried shrimps @ ₱0.24 per kilogram	₱ 1.63	₱ 1.71	₱ 1.68
Total cost of grain consumed	₱10.46	₱11.00	₱10.80
Average daily grain per pig	0.447 kgm.	0.47 kgm.	0.461 kgm.
Grain feed consumed per kilogram gain	3.476 "	3.423 "	3.152 "
Cost of grain to produce 1 kilogram gain	₱ 0.2326	₱ 0.23	₱ 0.21
Grain feed consumed per 100 kilogram gain	134.76 kgm.	342.30 kgm.	315.20 kgm.
Cost of grain to produce 100 kilogram gain	₱23.26	₱23.00	₱21.00

TABLE 4

Showing summary of results of experiments I, II, and III

EXPERIMENT NO.	DURATION	AGE OF PIGS	LOT NO.	RATION	NUMBER OF PIGS	AVERAGE INITIAL WEIGHT OF PIGS	NUMBER OF DAYS	TOTAL GAIN	AVERAGE DAILY GAIN PER PIG	GRAIN TO PRODUCE 1 KGM. GAIN	COST OF CONCENTRATE PER 100 KGM. GAIN
		months				*kgm.*		*kgm.*	*kgm.*	*kgm.*	*pesos*
I	July 5, 1926 to Aug. 29, 1926	3½	I	(Uncooked) Corn meal....20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	9	6.56	55	78.8	0.159	4.0383	27.58
			II	(Cooked) Corn.....20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	9	6.56	55	52.4	0.106	4.7171	32.17
II	May 1, 1927 to July 10, 1927	3½	I	(Unsoaked) Shelled corn...20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	7.634	70	56.63	0.1618	3.757	26.40
			II	(Soaked) Corn meal....20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	7.63	70	74.65	0.2132	3.106	21.89
			III	(Unsoaked) Corn meal....20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	7.624	70	59.98	0.1713	3.597	25.27
III	Sept. 4, 1927 to Nov. 13, 1927	3	I	(Soaked) Shelled corn...20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	5.748	70	44.96	0.1284	3.476	23.26
			II	(Cooked) Shelled corn...20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	5.754	70	47.73	0.1363	3.423	23.00
			III	(Soaked) Corn meal....20 parts Rice bran.....60 " Copra meal...15 " Dried shrimps. 5 "	5	5.674	70	51.23	0.1462	3.152	21.00

AN AGE OF INSECTS, NOT OF MAN: SOME NOTES ON THE FOURTH INTERNATIONAL CONGRESS OF ENTOMOLOGY[1]

FRANCISCO M. SACAY

"It is a startling thought to egotistical humanity that this is not the age of man: it is the age of insects; that man is a newcomer; that he is as yet an experiment, and that the same may be said of his immediate and in fact of his very remote ancestors—of the whole vertebrate series." Thus runs a statement in the keynote address by Dr. Leland O. Howard, when he opened the Fourth International Congress of Entomology held at Cornell University between August 12 and 18, 1928.

This congress is considered as one of the largest entomological congresses ever assembled, and was attended by about 600 of the most distinguished entomologists from all the states in the United States and thirty foreign countries.

The opening speeches were delivered by Dean A. R. Mann of the New York State College of Agriculture, and Dean W. A. Hammond of the University Faculty, both of whom welcomed the guests; and by Doctor Howard, as noted above. Doctor Howard was for many years the Chief of the United States Bureau of Entomology. He is honorary curator of the Department of Insects, U. S. National Museum, and president of the Fourth International Congress of Entomology. He also has the distinction of being the first American to finish the course in entomology which was established by Prof. J. H. Comstock in Cornell University in 1872.

In connection with his reference to this age as being an age of insects, he cited the following opinion of W. C. Allee, professor of zoölogy: "In time this may become the age of man, the most highly developed mentally of the vertebrates, but at present he is only beginning to dispute the ascendancy of his rivals, the highly specialized insects crowning the Arthropod series." Man undoubtedly is greatly outnumbered by insects, for entomologists believe that "there are immeasurable millions of insects, and that estimates of the possible number of species run from five to twenty-five millions."

[1] General contribution from the College of Agriculture No. 212.

These interesting and valuable notes were sent the editor by Mr. Francisco M. Sacay, B. S. '27. Mr. Sacay, now a U. P. Fellow in Cornell University, majoring in Rural Education, was formerly an instructor in Rural Economics in this College. It is gratifying to receive this evidence of interest in this College from a Fellow and to know that he is using his opportunities for lengthening his mental diameter in other lines than his chosen subject. Graduate students are too apt to become men with "single track" minds.

Known species of fleas, number 800

Dr. Karl Jordan of the Zoölogical Museum of Tring, England, who read a paper on the problems of distribution and variation of North American fleas, estimated that the total number of species of fleas occurring in the United States and Canada is over 200, and taking all parts of the world, 800. Said Doctor Jordan: "I don't think we know more than one-third of the species of fleas actually in existence."

650,000 distinct species of insects known

Professor Filipo Silvestri of Italy, in his paper, stated that some 650,000 distinct species of insects are known to entomology, and ventured the opinion that at least five times as many actually exist. He also mentioned the contribution of applied entomology and the valuable information it gives to humanity "through studies of mosquitoes, flies, fleas, and insects injurious to plants." The yearly losses caused by grasshoppers in many countries is enormous, he said, and he emphasized the importance of a more careful study of this insect and its parasite.

Tiny wasp, an ally of man against cane borer

In a paper on "The Egg Parasite" by W. E. Hinds and H. Spencer, entomologists in the Louisiana Experiment Station, the importance of a tiny wasp as an ally of man in his fight against the sugar cane borer was discussed. These men find it practicable to breed these wasps in the laboratory during the winter season "thus securing a large supply for field colonization work on cane borer eggs during the first half of the season." Their experiments indicate strongly "that there is a definite possibility of starting the field attack on the cane borer, or some early appearing host eggs, several weeks earlier in colonized fields than natural parasitism will appear in uncolonized areas".

Employing weed eaters

Experiments on the employment of insects in the extermination of pest plants and weeds were described by Dr. A. D. Imms, chief entomologist at the Rothamstead Experiment Station, England. He has been working on the control of pest plants by introduction of insect enemies of these plants. However, this is not so simple as it appears to be, for imported insects may change their "diet" in a new place and, instead, becomes pests of crops which they might find more "savory". Furthermore, if an insect is to do its work successfully, it must be free from its natural parasites.

Dr. R. J. Tillyard, entomologist from Australia, had made similar studies and found that this method of control—which is termed 'biological control'—is the most practicable means of dealing with large areas in a sparsely populated country.

Ants valuable help

Professor H. A. Eidman, of the University of Munich, who discussed the economic value of ants in relation to German forests, said that few species of ants are really injurious, and that their utility is much greater than their destruction, for they keep the forest in a sound state, especially the red hill ant (*Formica rufa* and its race). "Being an insect of prey it feeds almost entirely on other insects which it usually seizes alive according to my experience gathered in the hunting grounds of the colonies of red hill ants." Professor Eidman calculated that about two million insects were destroyed in one summer by a large colony of ants. Their importance was clearly shown during the period of the great pine moth pest of Northern Germany in 1924, when about 375,000 acres of forest were destroyed. "Whenever there had been ant hills the forest remained uninjured to a greater or smaller extent," he explained, and "no ant hills existed in the vicinity of the forest which was ruined."

Insects of the upper air

A study of insects of the upper air was made by Dr. E. P. Felt of the Bartlett Research Laboratories of Stanford, Connecticut, by collecting insects on the tops of high buildings in large cities, and in places which are not the natural habitat of such species. His conclusion was that this unusual distribution of insects could be explained as due to air currents rather that to purposive migration, but this conclusion he said, has not been established beyond doubt.

Tries bites of poisonous insects

Dr. W. J. Baerg, of the University of Arkansas, whose interest lies in the study of poisonous and so-called deadly insects, was referred to by one of his friends in the congress as "having been bitten by more 'fatal' insects than any other entomologist." Doctor Baerg found that the belief that the tarantula often found in bunches of bananas is deadly poisonous is not true, for "most or nearly all tarantulas are harmless". The same is true of many members of the scorpion family, although the Durango species has been the cause of many deaths, and it generally proved fatal to guinea pigs and rabbits. In order to observe the effects on man he took a small dose of the poison, but "experienced nothing worse than a 'severe' pain."

Species and evolution

Dr. Walter Horn of Berlin, in the course of his talk, asked whether the existence of species is a negation of evolution. His own answer was: "No. Species serve only as rests, as pauses in the respiration of evolution. Do not forget that the final clearing up of the notion of species would be nothing else but finding not only the actual tree of life, not only its root, but even its seed-kernel."

Foreign insect invaders

The need for restriction against entry of foreign plants as a means of preventing the entrance of new and dangerous insect pests was discussed by Dr. C. L. Marlatt of the Bureau of Entomology, Washington, D. C. He said that millions of dollars are being spent to control the insect pests which have entered the United States from foreign countries, and that losses caused by them run into billions of dollars. Some of the foreign invaders cited by him are the Hessian fly, the San José scale, the boll weevil, the chestnut blight, the Oriental fruit worm, the Japanese beetle, the white pine rust, and the European corn borer. For the control of the European corn borer alone Congress appropriated $10,000,000 this year.

Importance of congress

Dean Mann emphasized the importance of such contact among workers in the same and related fields as the "surest guarantee of reliable progress and the greatest incentive to superior achievement"; that "progress will be accelerated by an increasingly close and intimate fellowship among men of science and the integration of minds engaged in related fields of inquiry."

Dean Hammond regards such congresses as an important phase of modern science and letters because "scholars come into living contact, and at times into stimulating intellectual conflict, with one another", and that the free and unhampered exchange of ideas and opinions promote increasing progress of inquiry.

ABSTRACT[1]

The effect of borders in farm crops experiments. JUAN PEGIÑA. (*Thesis presented for graduation, 1928, from the College of Agriculture No. 274; Experiment Station contribution No. 562*).—The main object of this experiment was to find out "the effect of borders in farm crops experiments". The materials used for this piece of investigation were soybean, variety Ami; corn, variety Calauan Yellow Flint; upland rice, variety Cañabongbong; and lowland rice, variety Bal-latini.

With corn, dry and wet season crops were planted. With the other crops there was only one planting. For upland rice, the drill method was employed, and for lowland rice the ordinary method. With soybean the seeds were planted in plots of 11×5 meters.

The author obtained the following results:

With corn, for both the rainy and the dry season crops, no definite conclusions could be drawn as to border effect. In the rainy season corn crop the average production of ears per hill in the first two border rows were: 261.50 ± 0.364, and 272.17 ± 0.451 grams, respectively; the average yields for the next four rows were: 253.26 ± 0.305, 164.24 ± 0.360, 206.67 ± 0.189, and 207.45 ± 0.284 grams, respectively. In the dry season corn crop the average production of ears per hill from the five border rows were: 269.68 ± 0.216, 409.01 ± 0.218, 370.26 ± 0.165, 409.45 ± 0.153, and 409.22 ± 0.186 grams, respectively.

With the upland rice no definite conclusion could be drawn as to border effect. The average yields of panicles per one-meter section from the first six rows were: 74.41 ± 0.237, 60.30 ± 0.256, 18.22 ± 0.260, 69.17 ± 0.201, 67.90 ± 0.167, and 71.63 ± 0.297 grams, respectively. With the lowland rice, clean border had a slight effect on the yield of panicles. The yield of panicles per hill from the first border row was 13.51 ± 0.267 grams. The average yields of panicles per hill in the next four border rows were: 10.72 ± 0.847, 9.59 ± 0.226, 12.49 ± 0.314 and 10.06 ± 0.283 grams, respectively.

With soybean, the border effect on the height of plants was found significant in the first border row, being 42.12 ± 0.245 centimeters; the heights of plants in the next four border rows were: 29.94 ± 0.380, 30.46 ± 0.241, 34.12 ± 0.188 and 33.94 ± 0.175 centimeters, respectively.

—*Abstract by Clemente E. Yango.*

[1] Abstract prepared as part of required theme work in English 6, College of Agriculture.

EXTENSION DIVISION NOTES

College Extension Work in Visayas

Early in September Mr. Moises M. Kalaw, Extension Assistant of the College of Agriculture, went to the Visayan Islands to direct the construction of two copra driers. One, a 6,000-nut-a-day capacity for Mr. Teofilo Mejia's hacienda at Puerto Bello, Ormoc, Leyte and one for Mr. Espiridion Villegas' hacienda at Tabon, Vallehermoso, Oriental Negros. Mr. Kalaw stopped at Guimaras Island, Iloilo to examine the copra drier which was built in May, 1927 for the Cabano Estate by Mr. P. Zimmermann, Plantation Manager, following the direction of the College Circular No. 11 on the "New College Copra Drier".

Mr. Kalaw reported that he found this copra drier working in perfect order, and it is considered to have passed the experimental stage. The people concerned in the Cabano Estate which has a plantation of 280,000 coconuts are satisfied with the drier. A complete report of its working will be given later. In the course of the construction of the drier at Puerto Bello, people from different parts of the province, especially from the Leyte Farm School at Baybay, came to watch the work and learn of the structure by actual inspection.

The Eighth Agricultural Congress

The College Extension representative in semi-official capacity attended the Agricultural Congress the last two days of its five-day session (September 11-15). Two resolutions were presented by him to the Congress; they were:

1. Resolution to the effect that the Legislature be petitioned to increase the appropriation devoted to the establishment of agricultural schools so as to enable every province in the Islands to establish a school for vocational instruction in agriculture, commerce, and industry;
2. Resolution urging the Agricultural Congress to take definite steps in organizing a separate farmers' association for each of the main agricultural industries of the Islands, such as rice, coconuts, abaca, tobacco, which call for a collective effort on the part of their respective growers.

The aim of the first resolution is to develop in each province a farm agricultural school or another vocational type of school that will best meet the particular need of that province for boys and girls especially trained in practical work along the agricultural and industrial lines representing the major occupations of the people in the province. It is a plan that seeks for more or less exclusive training of the students from the different municipalities of the province in its principal industries in agriculture or otherwise. To this end, stress will be laid on such industries as represent the dominant occupations of the people in the province. Thus, if abaca, coconut, sugar cane, tobacco or animal industry is the principal means of livelihood and the main source of income of the people, the course of study should be so framed

that the strength of the course would lie in this direction. The academic and general part of the instruction, while important and should receive a proper share of attention, should be subsidiary to the main course. Thus if the local need of the province for trained youth in its own main industries be supplied the agricultural and economic development of the province would be more effectively served educationally. The establishment of such a type of school as rapidly as possible in every province will place before the boys and girls an equal opportunity for training for the industries in their communities.

The second resolution has for its aim the development among the farmers of the spirit of association and co-operation so that they may in time reap the benefit from acting together in the business of producing and marketing their crops and improving agricultural industry in all its aspects. In this connection the Philippine Sugar Planters' Association and the Cattle Producers' Association are examples. While these new associations do not have an established connection with the Agricultural Congress, a number of their members are members of this body. Now, if the associations for our different staple crops were formed by the initiative taken in the convention of the Agricultural Congress, this body may be made the federation body of the smaller organizations. Such a plan if effected would lend a new vigor to the Philippine Agricultural Congress.

Liberalization of Philippine Land Law

The Agricultural Congress was vigorously opposed to changes in our land law. The consensus of opinion was that the acreage of our unoccupied public land is too limited to justify the increase of the area granted corporations under the provisions of the present land law. Practically all were agreed that the pressing and urgent need is to facilitate the occupation of our unoccupied public land by homesteaders through insuring the applicants that their homesteads on which they file be absolutely free from adverse claims. Further than this, there was no dissenting opinion as to urging the government to speed up the issuance of Torrens titles to homesteaders who have duly complied with the requirements of the law. It was practically concluded that the old principle that land uniformly distributed among the people, small land owners forming the vast majority, is the surest basis and guaranty for stability in all orders of life.

This discussion was important for land ownership is the greatest incentive to good farming. But mere land owning does not help a man nor his community unless he keeps his land under cultivation and makes it increasingly productive year after year. Unless the owner of the land attends to his farm business and constantly improves his farming and marketing methods—eventually joining hands with his neighbors and other farmers organized into an association for co-operative efforts—sooner or later he may lose his land by default in the payment of land tax or by unsatisfied obligations.

Herein lies the importance of the initiative of the last Agricultural Congress in undertaking the formation of associations of farmers having a common crop interest.

EXCHANGE NOTES

The millions of dollars invested in the movies and the pleasure of the millions of people who daily attend them is based on chemical impurity in gelatine. This announcement, in effect, was made in a lecture given by Dr. C. E. K. Mees, director of the Research Laboratory of the Eastman Kodak Company. "It has recently been found," said Dr. Mees, "that the sensitiveness of films is not due to the grains of silver bromide only, but is in some way connected with the presence on those grains of specks of some other substance, and the Kodak Research Laboratories after a long and careful study have found that these specks are produced by an accidental impurity present in the gelatine. This impurity is derived from the plants eaten by the animals from whose skins the gelatine is made. There is only a very small amount of it, but it is a compound which contains sulphur, and when the gelatine is used for making the film, the sulphur reacts with silver bromide and produces specks of silver sulphide on the crystals. In some way or other these specks increase the effectiveness of the light to which the film is exposed in the camera and enable the light to change the silver bromide so as to form a trace of metallic silver. Then this silver acts during development as a nucleus on which more silver can deposit by the chemical process until the whole of the silver bromide crystal is turned into silver. Each of the original crystals of the film therefore, after exposure to light, becomes a grain of silver in the developed film, and it is of these grains of silver that the image projected on the screen is exposed.

—*Science.*

Unless the farm is managed as a business, the yield of every cow recorded, the low producers eliminated, and only the big yielders and their progeny kept, the natural advantages of good fertile land, large rainfall, and magnificent fresh-water streams cannot be put to maximum use.

—*The Agricultural Gazette of N. S. W.*

Handkerchief imports into Manchuria are valued at about $50,000 a year. Japan and Great Britain are the chief suppliers. The type sold in largest quantities are cotton handkerchiefs with drawn-thread hem.

—*Commerce Reports* (U. S. A.)

It costs sixty cents to grow a bushel of corn in Iowa according to the average found on ninety-three farms where corn production cost was given

special study by agricultural economists of Iowa State College, working in co-operation with the farmers. These farms are probably above the average, so the actual state average would be somewhat higher, the economists say.

—*The Farmer and Stockman.*

Cornell University has now in progress a fellowship devoted to the study of the use of dry skim milk and ice cream. Preliminary results are encouraging and it is expected that findings will lead to greater use of dried milk, thus creating a wider market for this comparatively new product.

—*Butter and Cheese Journal.*

Toe picking and feather picking among chicks does not necessarily indicate a deficiency in the ration, but often become a matter of habit, according to Roy E. Roberts of Purdue University.

These vices usually start by a toenail or feather being pulled out accidentally. The blood attracts the other chicks and they start picking. This soon leads to cannibalism and several chicks may be seriously injured or even killed. The troubles are more apt to develop in a crowded brooder house.

The most satisfactory means of preventing and controlling the trouble is to avoid crowding the chicks, and by getting them out of doors as soon as possible. If chicks must be confined indoors, care should be taken not to crowd them. Keep the mash hoppers full, and give them things to keep them busy such as pieces of green sod. When chicks start picking one another, remove the injured ones at once.

—*The Prairie Farmer* (Illinois).

It is gratifying to report from time to time the steady advancement of the control of tuberculosis in this country. Millions of dollars and months and years of arduous labor are being put into this work. At times it would seem that very little progress is being made, yet in looking back over the past year or two it will be found that real progress has been accomplished. . . A fourth survey of the country recently completed indicates that bovine tuberculosis now affects only about two per cent of the animals as against four per cent at the time of the first survey in 1922.

—*Guernsey Breeders' Journal.*

The most successful annual meeting yet held by the Canadian Seed Grower's Association came to a close at the Chateau Frontenac on June 16th. The reports of the directors showed an increasing demand by farmers

for registered seed, the highest grade of pure seed that can be produced and which is produced by members of the association.

—*The Journal of Agriculture and Horticulture.*

An increase of one and one-half to three times normal production has been obtained by the United States department of agriculture when garden land was covered with heavy asphalt saturated paper. This is an adaptation of the practice commonly used in the pineapple fields of Hawaii.

The use of paper mulch, besides increasing yields, eliminates all weeds between rows, facilitates weeding between plants in the row, and does away with the necessity of cultivation. In certain crops there is a marked hastening of maturity, and an increase in germination. The crop is also improved in size, quality and cleanliness.

—*Successful Farming.*

COLLEGE AND ALUMNI NOTES

Professor Michael F. Guyer, Head of the Department of Zoölogy of the University of Wisconsin was a Campus visitor on October 9, 1928. Professor Guyer was accompanied by Dr. Serafin Macaraig of the College of Liberal Arts of the University of the Philippines. Professor Guyer is the author of two popular textbooks, *Being Well Born*, an introductory textbook to the study of Eugenics and *Laboratory Technique for Biology Students*. The Acting Dean, a former student of Professor Guyer, showed him around the Campus. He was particularly interested in the departments of Zoölogy, Parasitology, and Animal Husbandry.

Miss Margaret Wilson formerly of the staff of the Department of English sent two boxes of books for use in the department. Also seventy-five phonograph records to be distributed among the Molawin Hall, College Lunch and Forget-me-not restaurants and the Forest School. The recipients of these much needed books and records are grateful for Miss Wilson's generous kindness.

Under the auspices of the Junior Agricultural Congress, Mr. Faustino Reyes, Chief of the Division of Public Lands, Bureau of Lands, spoke at the Student Body Convocation in September on "How students and alumni of the College of Agriculture may acquire land under the provisions of Public Land Laws." The students were much benefited, as the subject was admirably presented.

In the morning of Sunday, October 1, 1928, Dr. R. B. Espino, Head, Department of Plant Physiology, gave a one-hour lecture on botany to students enrolled in biology in the Columbian Institute.

In the afternoon of the same day Doctor Espino gave a lecture to students taking botany in the College of Education of the University of Santo Tomas.

Cards have been received from the United States announcing the marriage of Miss Marcia Whipple and Lt. Elmo Shingle of the United States Army. Miss Whipple was formerly on the staff of the Department of English.

The Department of Animal Husbandry just completed the construction of a silo. This is, so far as the department knows, the second silo constructed in the Philippines, the first one being in Alabang. The silo is eight feet in diameter and twenty-four feet high and has a capacity of about twenty-two tons. About thirteen tons of corn fodder was put in as an experimental filling on September 18, 1928.

At the suggestion of several resident members of the Sigma Xi Society, an honorary scientific fraternity in the United States, a meeting was held in the office of Dr. N. B. Mendiola on September 11, 1928. It was unanimously decided in this meeting to organize a local Sigma Xi Club. Steps are now being taken to affiliate this club with the central office of the society in New York. Dr. N. B. Mendiola was elected temporary president of the club, and Dr. F. M. Fronda, temporary secretary.

The Sigma Xi members who were present are:

Dr. F. M. Fronda	Cornell (Alpha) Chapter
Dr. A. K. Gomez	Cornell (Alpha) Chapter
Dr. L. G. Gonzalez	Cornell (Alpha) Chapter
Dr. V. G. Lava	Columbia Chapter
Dr. N. B. Mendiola	Cornell (Alpha) Chapter
Dr. G. O. Ocfemia	Wisconsin Chapter
Dr. M. A. Tubangui	Cornell (Alpha) Chapter
Dr. D. Villadolid	Stanford Chapter

The other residents Sigma Xi members who were not able to be present at the meeting are:

Dr. F. O. Santos	Yale Chapter
Dr. M. D. Sumulong	Michigan Chapter
Dr. T. Vibar	Illinois Chapter
Dr. R. L. Pendleton	California Chapter

The Los Baños Biological Club held its thirty-eighth scientific meeting in the Auditorium of the College of Agriculture on October 4, 1928.

The papers read and discussed were:

"A promising cassava grater for the farm"
by Mr. Zosimo Montemayor.

"Accuracy in the weighing of experimental chickens"
by Dr. F. M. Fronda.

"Studies on the factors influencing the distribution of hookworm infestations in the Philippines."
(Read by Doctor Tubangui).
by Drs. M. A. Tubangui and R. Q. Javier.

The last number of *The Makiling Echo*, quarterly journal published by the School of Forestry contains articles on "Moisture Content of Mangrove Barks," "Agricultural Settlement and its Solutions" and other interesting shorter articles and notes.

Mr. Alejandro B. Catambay, who was graduated from the College of Agriculture with the degree of B. Agr. in 1924 and B. S. in 1925, and from the University of California in May, 1927 with the degree of M. S. with major in farm machinery was appointed temporary instructor in Agronomy in our College effective August 1, 1928. Mr. Catambay is at present assigned to the division of farm machinery and implements of the Department of Agronomy.

Mr. E. de Bragança Pereira, B. S. '21, writes Doctor Mendiola that he is employed as Agricultural Expert in the Department of Agriculture, Northern Division, Portuguese India.

The tenth anniversary of Loyalty Day, October 10, was ushered in with Loyalty Day Students' Parade. This was followed by review of the Corps of Cadets by His Excellency, the Governor General. At the end of review Governor General Stimson addressed the Cadets.

The program at the band stand with Lt. Amado Martelino, Chairman of Committee of arrangements, presiding, opened with the singing "Third Battalion March" by the Cadet Corps. Mr. Basilio Viado, a National Guard Veteran, spoke briefly. A Cadet quartet sang a group of "Old Time Songs." Major Gilmore, commander of U. P. Cadets, gave a brief address. This was followed by the singing of "Varsity March" by the students. President Palma gave the principal address of the day.

Regent Zamora presented a medal to Campus Guard Pablo Estubesa and to member of family of Guard Joaquin Onglao who was killed by the

bandits in the recent attempts to rob the College safe. Guard Estubesa was badly wounded. These medals were donated by Regent Zamora, who was a member of the first class graduated from this College. The College song "Hail College Dear" by students closed the program.

The faculty were hosts at a luncheon in Molawin Hall to the guests of the day.

In the afternoon members of the faculty and Alumni put up a good fight against the Seniors and Juniors in baseball, volley ball, soccer football, cage ball and relays.

A free movie at the Auditorium under the auspices of the Military Science Department closed the "perfect day."

A new feature of the day's celebration was the Student Parade. This was initiated by the Department of English and carried out under its direction, assisted by the Department of Military Science.

College organizations each with some distinguishing feature in dress and with the Cadets in platoons formed the procession. The order of march was:

Order of March

1. Forest School Platoon Cadets
2. National Guard Veterans
3. Cadets Company I, Platoon 1
4. Senior Class
5. Whangdoodles
6. Tobacco Junior Planters' Association
7. Cadets Company I, Platoon 2
8. Screeching Owls
9. Catholic Truth Society
10. Cadets Company I, Platoon 3
11. Associated Women Students
12. Cadets Company K, Platoon 1
13. Andelros Club and Association of Sugar Technologists
14. Syncopating Sillies
15. Cadets Company K, Platoon 2
16. Self-Made Man Association
17. Cadets Company K, Platoon 3
18. Ranchers' Club
19. The Mimics
20. Junior Agricultural Congress
21. Cadets Company L, Platoon 1
22. Howling Hooligans
23. Aggie Pensionado Club
24. Cadets Company L, Platoon 2
25. The Four Horsemen
26. The Seedlings
27. Cadets Company L, Platoon 3

Each organization merited the praise it received. Space does not permit descriptive comments. The Whangdoodles, the Syncopating

Sillies (with ukeleles), the Four Horsemen masked, mounted on poles with realistic horse's heads (all these for fun); the Screeching Owls and the Howling Hooligans (groups to lead the singing) were arranged and costumed by the Department of English. They are *not* College organizations.

The parade marched first to the Auditorium, the scene of the National Guard enlistment in 1918. Here the eight National Guard Veterans who under escort led the parade, formed in front the building. A volley was fired in salute and the buglers blew "Call to Colors." The route of march led past department buildings which were saluted, then across Molawin Creek to the Athletic Field. Here the procession passed in review before and salaamed to His Sublime Majesty, King Loyadpar. His Majesty, Felix Sarao, robed in royal purple—his scepter a long shining bolo, sat in royal splendor under a canopy upheld by bearers, the court fanners kept him cool with Filipino brooms, guards in shining coats of mail protected him. Trumpeters announced each section of parade—while all the time the court jester, Salvador Sales made merry.

There was a fine rollicking student spirit in it all. The King summoned the Amah (a whangdoodle) to bring his infant (in a wheelbarrow perambulator) to his throne. In Jove-like tones he proclaimed the child the hope of the country, gave him a shovel saying, "Learn to use this and you will be part of the backbone of your country."

The couple "going to Mindanao in a carabao cart" (Senior Class) were given royal salute. As a finale the King commanded a trumpeter to summon Megaphone High Muck-a-Muck (who directed the singing in marching) to appear before him. With the old time ceremony King Loyadpar, for expert service, knighted the megaphoner, Antonio Flores, "Sir Muck-a-Muck."

It is hoped that the Students' Parade will in the future be a feature—in time *the* feature of Loyalty Day.